ID NUMBERS

This manual applies directly to the products with ID numbers suffixed 126.

For additional information on ID numbers refer to 1-2 ID NUMBER in SECTION I.

LOGIC ANALYZER

VP-3662A

Matsushita

Matsushita Communication
Industrial Co., Ltd.
4-3-1, Tsunashima-Higashi
Kohoku-ku, Yokohama, Japan
Tel: (045) 531-1231
Telex: 3822-671

SAFETY PRECAUTIONS

GENERAL

This instrument has been designed and tested to ensure reasonable personal protection and protection of the surrounding area against damage, and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation and to retain the instrument in a safe condition.

BEFORE SUPPLYING POWER

Verify that the instrument is set to suit the available mains voltage and that the correct fuse is installed.

PROTECTIVE EARTH

The protective earth of the instrument must be connected to the earth before connecting the instrument to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cable is essential for safe operation.
The plug shall only be inserted into a socket outlet provided with a protective earth contact.

SAFETY SYMBOLS

⚠ Instruction manual symbol : The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual for safety.

High voltage symbol : Dangerous voltage exceeding 1 kV is indicated by this symbol.

⏚ Protective earth terminal.

WARNING The WARNING sign is a heading of the requirement(s) that should be observed to avoid personal or fire hazards.

CAUTION The CAUTION sign leads the precaution(s) that should be observed to avoid damage or destruction of the instrument.

POWER SOURCE

This instrument is intended to operate from a mains supply that will not be more than 250 volts rms.
For suitable voltage selection, see the INSTALLATION paragraph in this manual.

HAZARD ARISING FROM LOSS OF GROUND

The protective action must not be negated by the use of an extension cord without protective conductor.
If this instrument is to be energized via an autotransformer for voltage reduction make sure the common terminals is connected to the earth terminal of the power source.

DAMAGE IN TRANSPORT OR STORAGE

Whenever it is likely that protection has been impaired, for example as a result of damage caused by abnormal stresses in transport or storage, the instrument shall be made inoperative and be secured against any unintended operation.

USE OF PROPER FUSE

Use only the fuse of correct type, voltage rating and current rating as specified in the INSTALLATION paragraph in this manual.

REMOVAL OF COVERS

Removal of covers is likely to expose live parts although reasonable precautions have been taken in the design of the instrument to shield such parts. The instrument shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the instrument shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a qualified personnel who is aware of the hazard involved.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

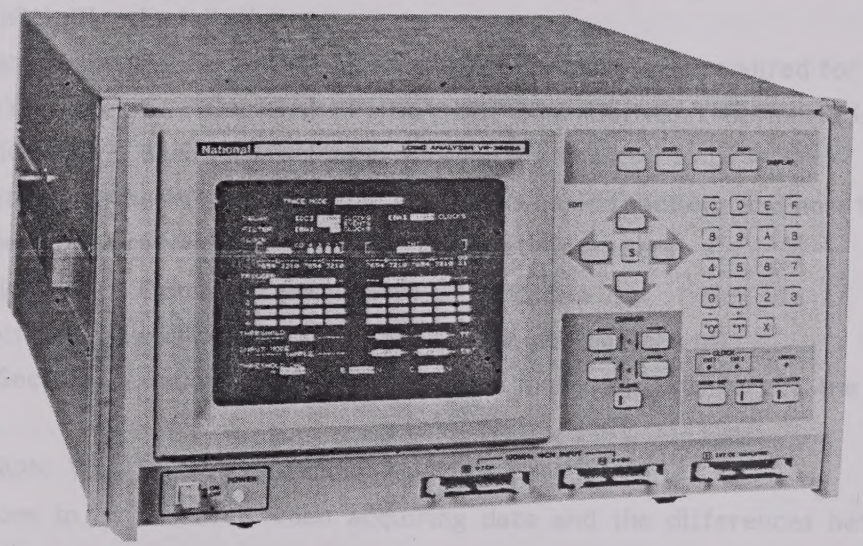
To avoid explosion, do not operate the instrument in an explosive atmoshpere.

TABLE OF CONTENTS

Section			Page
I	GENERAL		1 - 1
	1-1	Structure of this manual	1 - 1
	1-2	ID number	1 - 2
	1-3	Outline	1 - 2
	1-4	Principle of operation	1 - 3
II	SPECIFICATIONS		2 - 1
	2-1	MAIN mode	2 - 1
	2-2	HIGH mode	2 - 3
	2-3	General	2 - 5
	2-4	Accessories furnished	2 - 5
III	INSTALLATION		3 - 1
	3-1	Power requirements	3 - 1 ⚠
	3-2	Mains voltage selection	3 - 1 ⚠
	3-3	Fuse	3 - 1 ⚠
	3-4	Power cable	3 - 2
	3-5	Mounting considerations	3 - 3
	3-6	Interconnection with other equipment	3 - 3
	3-7	Environmental condition	3 - 3
	3-8	Probes	3 - 3
	3-9	Connecting probes	3 - 4
IV	BASIC OPERATIONS		4 - 1
	4-1	Self-diagnosis	4 - 1
	4-2	Battery back-up	4 - 1
	4-3	Trace modes	4 - 2
	4-4	Operation summary	4 - 5
V	DETAILED DESCRIPIONS OF FUNCTIONS		5 - 1
	5-1	Basic procedure	5 - 1

Section			Page
	5-2	Keyboard	5 - 3
	5-3	Menus	5 - 9
	5-4	Input	5 - 15
	5-5	Triggering	5 - 25
	5-6	Qualifiers	5 - 49
	5-7	Delay	5 - 52
	5-8	Filter	5 - 55
	5-9	Cursors	5 - 56
	5-10	Scrolling	5 - 60
	5-11	Scrolling by pages	5 - 61
	5-12	Channel sequence	5 - 61
	5-13	Polarity	5 - 63
	5-14	Blanking	5 - 64
	5-15	Measuring trigger time intervals	5 - 65
	5-16	Reference memory	5 - 67
	5-17	Search	5 - 69
	5-18	Zooming	5 - 70
VI		DATA ACQUISITION	6 - 1
	6-1	General precautions	6 - 1
	6-2	32ch trace mode	6 - 3
	6-3	16ch(1) mode	6 - 7
	6-4	16ch(2) mode	6 - 11
	6-5	Reset if	6 - 15
	6-6	REP/SINGLE key	6 - 18
	6-7	Setting change on menus	6 - 18
	6-8	Using external clocks	6 - 19
VII		DATA DISPLAYS	7 - 1
	7-1	Brief introduction	7 - 1
	7-2	State display mode	7 - 2
	7-3	Timing diagram display	7 - 11
	7-4	Map 1 display	7 - 27
	7-5	Map 2 display	7 - 31

Section		Page
VIII	OUTPUT	8 - 1
	8-1 Trig out 1	8 - 1
	8-2 Trig out 2	8 - 2
	8-3 Reset out	8 - 2
	8-4 Video out	8 - 2
IX	OPTIONS AND ACCESSORIES	9 - 1



VP-3662A

SECTION I
GENERAL DESCRIPTION

1-1 STRUCTURE OF THIS MANUAL

This manual is divided into the following Sections :

(1) SECTION I General Description

A brief introduction to the VP-3662A Logic Analyzer and its principle of operation.

(2) SECTION II Specifications

A list, in tabular form, of the major specifications of the VP-3662A.

(3) SECTION III Installation

Instructions on the electrical and mechanical preparations required for safe use.

STUDY THIS SECTION CAREFULLY BEFORE USING THE INSTRUMENT.

(4) SECTION IV Basic Operations

An outline of the VP-3662A Logic Analyzer's basic functions and how to operate them.

This Section is recommended reading for first-time users.

(5) SECTION V Detailed Descriptions of Functions

A function-by-function listing of applications and operations.

This Section is recommended reading for those wanting to get the most from the instrument.

(6) SECTION VI Data Acquisition

Cautions to be observed when acquiring data and the differences between the three trace modes.

(7) SECTION VII Displaying Data

Instructions on displaying and interpreting the data stored in the instrument.

This Section helps the user to more effectively analyze the stored data.

(8) SECTION VIII Output

Instructions on output signals of the instrument.

(9) SECTION IX Optional Accessories

Brief descriptions of the optional accessories currently available to extend the instrument's range of application.

(10) Miscellaneous

Photographs, drawings, and an index to the technical terms.

1-2 ID NUMBER

This instrument is numbered with a ten-character ID number. The first seven digits and letter(s) are assigned uniquely for each product. The last three digits comprise the ID suffix which is the same for all identical products and changes only when a change is made. All correspondence with the factory or representatives concerning this instrument should include the complete ten-character ID number.

The contents of this manual apply to products numbered with the same ID number suffix(es) as noted under title of ID NUMBERS on the first page of the manual.

1-3 OUTLINE

The VP-3662A Logic Analyzer, a valuable tool for the design, development, and debugging of digital equipment, acquires multi-channel logic signals simultaneously and stores them for display and analysis on a CRT screen.

Options to extend this basic function include : Personality Kits which disassemble machine instructions back into mnemonics and GP-IB and RS-232-C analyzers which convert bus signals into a display that is easier to interpret.

The VP-3662A features :

(1) High-speed processing of up to 48 input channels (up to 1,001 bits/channel)
16 channels with a high speed clock (100 MHz, HIGH mode)
32 channels with a low speed clock (20 MHz, MAIN mode)

(2) Three trace modes

In addition to tracing 16 channels with a 100 MHz clock (HIGH mode), the VP-3662A offers a choice of three modes for the 32 low speed (20 MHz clock, MAIN mode) channels.

* 32-ch synchronous tracing of 32 channels
* +16 ch(1) Synchronous and asynchronous tracing of two 16-channel groups
* +16 ch(2) Synchronous tracing of two 16-channel groups

(3) Four kinds of displays

STATE	Displays in state table format in binary, octal, hexadecimal, or ASCII codes (optional analyzers enable mnemonics)
TIMING	16-channels of data arranged into a timing diagram
MAP 1	Plot of upper half of data word vs. lower half (primarily for examining address bus operations)
MAP 2	Plot of data size vs. time (for analysis of address bus operations or D/A conversions)

(4) A variety of trigger functions

Sequential trigger four levels available

Glitch trigger	Triggering by glitches
Filtering	Eliminates accidental triggering by skewed channels or glitches
Event trigger	Allows specified number of occurrences of the keyword to pass before triggering
Trace trigger	Records only specified data items
Linking trigger	Links triggers for synchronous and asynchronous channel groups

(5) Optional accessories

* 8-bit CPU Personality Kits	8080, 8085, Z-80, 6802, 6809
* 16-bit CPU Personality Kits	8088, 8086, Z-8001, Z-8002, 68000
* GP-IB Analyzer	* GP-IB Interface
* RS-232-C Adapter	* RS-232-C Data Output
* RS-232-C Analyzer	

1-4 PRINCIPLE OF OPERATION

The block diagram in Fig. 1-1 outlines the circuit configuration of the VP-3662A Logic Analyzer.

Controlling the circuitry is an 8085 microprocessor which accepts data from the keyboard and the logical states from the peripheral circuits for the program stored in the PROGRAM ROM.

The voltage comparator in each probe uses the threshold voltage provided by the D/A converter to convert its input to a high or low logical state before passing this input on to the Logic Analyzer.

The first stage inside the Logic Analyzer is the sampling circuit (marked SAMPLE/LATCH in Fig. 1-1). The sampling circuit uses one of the two internal clocks or an external clock provided by a probe. The clock generator, a crystal oscillator, provides two independent internal clocks to the 20 MHz and 100 MHz sampling circuits.

From the sampling circuit, the data goes to the glitch detector which is designed to capture spike-like pulses shorter than the clock interval. During glitch trigger operation, it sends a trigger signal to the delay counter each time it detects a glitch.

The trigger detector compares the incoming data with the trigger word entered in the SEQUENTIAL TRIGGER portion of the MENU display and, when it finds a match, sends the appropriate signal to delay counter.

SECTION II
SPECIFICATIONS

Designation	Performance	Conditions or remarks
2-1 MAIN MODE		
(1) Input		
Data input channel	32 ch	Rear panel inputs.
Data qualifier input	2 ch	DQ 2, 1
Clock qualifier input	4 ch	CQ 4, 3, 2, 1
External clock input	2 ch	EXT 1, 2
Input impedance	1 MΩ, ≤ 15 pF	At probe input terminal.
Minimum swing	± 0.4 V	With reference to threshold level.
Maximum swing	± 35 V	With reference to threshold level.
Maximum permissible voltage	± 50 V	
Glitch detection capability	10 ns	Minimum glitch duration at threshold level.
(2) Clock		
Internal clock	50 ns (20 MHz) to 50 ms (20 Hz)	1-2-5 sequence.
External clocks		EXT 1, 2
Max. repetition rate	20 MHz	dc coupled.
Min. pulse duration	20 ns	At threshold level.
Set-up time	20 ns	
Hold time	0 ns	
(3) Delay, Memory		
Clock delay	0 to 65535 clocks	
Event delay	1 to 65535 events	
Main memory	1 K bits/ch	1001 bits on display.
Reference memory	1 K bits/ch	1001 bits on display.
(4) Triggering		
Sequential trigger levels	4 levels	T1 - T4 for all trace modes.
TRACE MODE 16 ch + 16 ch(1)		
COMB 1 x 2 x 3 x 4	Detects T1 to T4 in sequence.	DC and BA groups.
COMB 1 · 2 · 3 · 4	Detects consecutive T1 to T4.	DC group only.
BA TRIG	Triggered by BA group.	DC group only.
HIGH TRIG	Triggered by HIGH MODE section.	DC and BA groups.
NOT USED	When not used.	DC group only.
GLITCH	Triggered by a glitch	BA group only.
DC TRIG	Triggered by DC group.	BA group only.

Designation	Performance	Conditions or remarks
TRACE MODE 16 ch + 16 ch(2)		
COMB 1 x 2 x 3 x 4	Detect T1 to T4 in sequence.	DCBA group.
COMB 1 · 2 · 3 · 4	Detects consecutive T1 to T4.	DCBA group.
TRACE 1 x 2 x 3 x 4	Selective trace.	DCBA group.
TRACE 1 · 2 · 3 · 4	Selective trace.	DCBA group.
HIGH TRIG	Triggered by HIGH Mode section.	DCBA group.
NOT USED	When not used.	DCBA group.
TRACE MODE 32 ch		
COMB 1 x 2 x 3 x 4	Detect T1 to T4 in sequence.	DCBA group.
COMB 1 · 2 · 3 · 4	Detects consecutive T1 to T4.	DCBA group.
TRACE 1 x 2 x 3 x 4	Selective trace	DCBA group.
TRACE 1 · 2 · 3 · 4	Selective trace.	DCBA group.
BUS 1 x 2 x 3 x 4	Bus trigger with HIGH Mode section.	DCBA group.
BUS 1 · 2 · 3 · 4	Bus trigger with HIGH Mode section.	DCBA gorup.
HIGH TRIG	Triggered by HIGH Mode section.	DCBA group.
NOT USED	When not used.	DCBA group.
(5) Display		
TIMING	Timing diagram display of the stored data.	BA group in trace mode 16 ch + 16 ch(1) only.
STATE	State table display of the stored data in binary, octal, hexadecimal and ASCII codes.	Notation codes are selected for each 8 bits.
MAP 1	Dots display of the stored data on the coordinates.	DC group only in each trace mode.
MAP 2	Displays stored data with data size on vertical axis and occurrence order on horizontal axis.	DC group only in each trace mode.
Magnification		
TIMING	x 1, x 4, x 8, x 20 horizontally x 1, x 2, x 4 vertically	1 K bits display at x 1. 16 ch display at x 1.
MAP 1	x 1 : Each 8 bits for X and Y axes. x 2 : Each 7 bits for X and Y axes. x 4 : Each 6 bits for X and Y axes.	
Cursor	C cursor and R cursor	
Channel sequence	Any channel sequence can be arranged on display.	
Polarity	Display polarity of the stored data can be changed for each channel.	
Blanking	Data of any unwanted channel can be blanked on display.	

Designation	Performance	Conditions or remarks
(6) Other functions		
Trigger filter	1 to 16 clocks	BA group in trace mode 16 ch + 16 ch(1) only.
Comparison (M/R)	Alternate display of M and R data.	M : Main memory R : Reference memory
RESET IF		
=	Compares M data to R data, and resets M when it equals R.	Comparison range can be selected by means of C and R cursors.
≠	Compares M data to R data, and resets M when it does not equal R. The number of comparison times is 0 to 65535.	
SEARCH	The main memory is searched for a match of the data set on the Search Menu. Matched data are indicated on display screen.	The first and the last memory addresses of matched data and the number of matched data are also displayed.
Data acquisition (SINGLE/REP)		
REP (repeat)	Repeats data acquisition automatically after displaying data for about 1 second.	Light in the center of SINGLE/REP key is on.
SINGLE	Single aquisition.	Light in the key is off.
Time interval measurement	Displays the time intervals of triggers ; T1 to T2 to T3 to T4.	
	Accuracy : ±2 % at max. length of 99.999 s.	Resolution : 1 us
2-2 HIGH MODE		
(1) Input		
Data input channel	16 ch	Front panel inputs
Qualifier input	2 ch	Data/clock qualifiers
External clock input	1 ch	EXT CK3
External trigger	2 ch	ET1, ET2
Input impedance	1 MΩ, ≤ 8 pF	At probe input terminal.
Minimum swing	±0.4 V	With reference to threshold level.
Maximum swing	±35 V	With reference to threshold level.
Maximum permissible voltage	± 50 V	
Glitch detection capability	5 ns	Minimum glitch duration at threshold level.
(2) Clock		
Internal clock	10 ns (100 MHz) to 50 ms (20 Hz)	
External clock		CK3
Max. repetition rate	100 MHz	Asynchronous measurement.
	50 MHz	Synchronous measurement.
Min. pulse duration	5 ns	At threshold level.

Designation	Performance	Conditions or remarks
Set-up time	0 ns	
Hold time	5 ns	
(3) Delay, Memory		
Clock delay	0 to 65535 clocks	
Main memory	1 K bits/ch	1001 bits on display.
(4) Triggering		
Sequential trigger levels	2 levels	T1, T2
Function		
COMB TRUE	Triggered when acquired data matched the word.	The word : Trigger word that have been set by the user.
COMB FALSE	Triggered when mismatched after matching the word once.	
GLITCH	Triggered by a glitch	Detects all 16 channels.
DCBA TRIG	Acquisition stops with triggering of MAIN Mode section	Only when MAIN Mode section is other than 16 ch + 16 (1).
DC TRIG	Same as above.	Only when MAIN Mode section is 16 ch + 16 ch(1).
BA TRIG	Same as above.	Only when MAIN Mode section is 16 ch + 16 ch(1).
EXT	Triggered by external signals.	EXT1 ±, EXT2 ±
(5) Display		
TIMING	Timing diagram display of the stored data.	
STATE	State table display of the stored data in binary, octal, hexadecimal and ASCII codes.	Notation codes are selected for each 8 bits.
Magnification of timing diagram display	x 1, x 4, x 8, x 20 horizontally x 1, x 2, x 4 vertically	1 K bits display at x 1. 16 ch display at x 1.
Cursor	C cursor and R cursor.	
Channel sequence	Any channel sequence can be arranged on display.	
Polarity	Display polarity of the stored data can be changed for each channel.	
Blanking	Data of any unwanted channel can be blanked on display.	

Designation	Performance	Conditions or remarks
2-3 GENERAL		
Threshold	-6.35 V to +6.35 50 mV steps	Can be set for each probe. (Probes A, B, C, D, G, H and I)
Input mode		
Sample	Samples at the edge of each sampling clock.	
Latch	Also stores a glitch between sampling clocks.	
Output		
VIDEO OUT	V, H, Sync ; separated.	For a video printer only.
TG 1	Detection of T4 in synchronous measurement.	MAIN Mode only.
TG 2	Detection of T4 in asynchronous measurement.	MAIN Mode only.
RESET	TTL negative logic.	
CRT	8-inch rectangular type. Electromagnetic deflection.	Green phosphor.
Power requirements		
Mains voltages	100 V : 90 V to 126 V 200 V : 180 V to 250 V	
Mains frequency	50 or 60 Hz	
Power consumption	450 VA or less	
Ambient conditions	0 - 40 °C, 20 - 80 % R.H. -20 - 70 °C, 10 - 80 % R.H.	Limit range of operation. Storage and transportation.
Dimensions	380 mm wide, 200 mm high and 440 mm deep.	Excluding handles, feets and etc.
Weight	15 kg approximately.	Without accessories.

2-4 ACCESSORIES FURNISHED

4 ---------- Probe VQ-059A22	D to A inputs (20 MHz)
1 ---------- Probe VQ-059A23	E input (20 MHz)
2 ---------- Probe VQ-059A30	G, H inputs (100 MHz)
1 ---------- Probe VQ-059A31	I input (100 MHz)
2 ---------- Accessory box	
1 ---------- Power cord	
1 ---------- Spare fuse	
1 ---------- Instruction manual	

SECTION III
INSTALLATION

3-1 POWER REQUIREMENTS

The VP-3662A can be operated from any power source supplying 90 - 126 V or 180 -250 V, 50 or 60 Hz. Power consumption is less than 100 VA.

WARNING

Before connecting ac power to the instrument, be sure it is set for the proper mains voltage as indicated on the rear panel. (See Fig. 3-1)

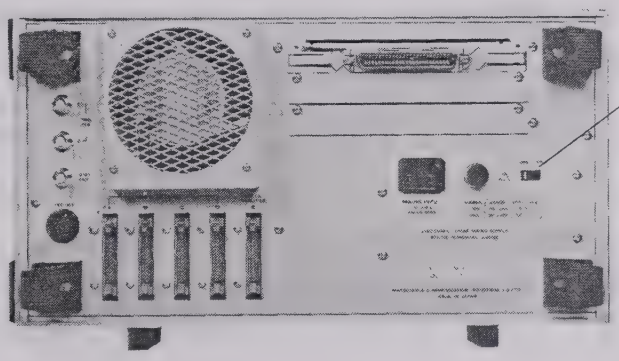


Fig. 3-1 Mains Voltage Selector

3-2 MAINS VOLTAGE SELECTION

Refer to Fig. 3-1. Set the voltage selection switch to the setting (100 V, or 200 V) that corresponds to the mains voltage to be used. The voltage must be within the range noted beneath the switch.

3-3 FUSE

Verify that the proper fuse is installed in the fuse holder. Ratings of the fuse are noted on the rear panel and listed below.

Nominal voltage	Fuse
100 V	250 V (T) 5 A
200 V	250 V (T) 4 A

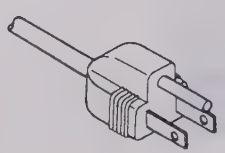
WARNING

Make sure that only fuse with the required rated current and of the specified type is used for replacement. The use of makeshift fuse and the short-circuiting of fuse holder are prohibited.

3-4 POWER CABLE

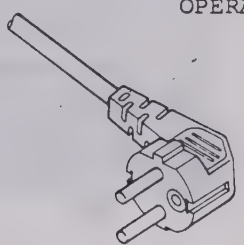
The VP-3662A is equipped with a detachable power cable assembly. The type of the plug shipped with each instrument depends on the country of destination. The figure below illustrates the power cables available with Matsushita part numbers.

125V OPERATION



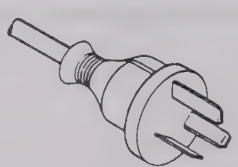
33-76B-2M

250V OPERATION



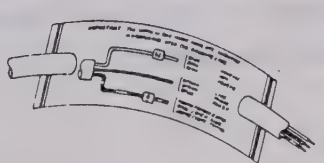
99-81-2M

250V OPERATION



418-481-2M

250V OPERATION



76W004

3-5 MOUNTING CONSIDERATIONS

The instrument cabinet has plastic feet and fold-away tilt stand. The tilt stand raise the front of the instrument for easier operation of the front panel controls.

CAUTION

The VP-3662A is equipped with a cooling fan located on the rear side.
The instrument should be mounted so that air can freely circulate through it.

1. Allow at least 3 cm of clearance on both sides.
2. Do not block the airflow from the cooling fan.
3. Do not operate the instrument set on the rear feet.

3-6 INTERCONNECTION WITH OTHER EQUIPMENT

Plug the power cable into a properly wired receptacle before connecting the instrument to the other equipment with probes or BNC cables.

3-7 ENVIRONMENTAL CONDITION

The rated performance of this instrument is guaranteed under the environmental conditions of 0 °C to 40 °C (temperature) and 20 % to 80 % (relative humidity).

Avoid using this instrument :

* under direct sunlight
* in the vicinity of equipment with strong magnetic fields and/or heat radiation
* under mechanical vibration

3-8 PROBES

The VP-3662A Logic Analyzer comes with eight probes : five for the MAIN mode (20 MHz) and three for the HIGH mode (100 MHz). Table 3-1 lists the four different types of probes included. Always check the Part No. printed on the probe case before connecting the cable and probe tips as shown in Fig. 3-2 (MAIN mode) and 3-3 (HIGH mode).

Table 3-1 Probe Types

Application	Part No.	Quantity
MAIN mode	VQ-059A22	4
	VQ-059A23	1
HIGH mode	VQ-059A30	2
	VQ-059A31	1

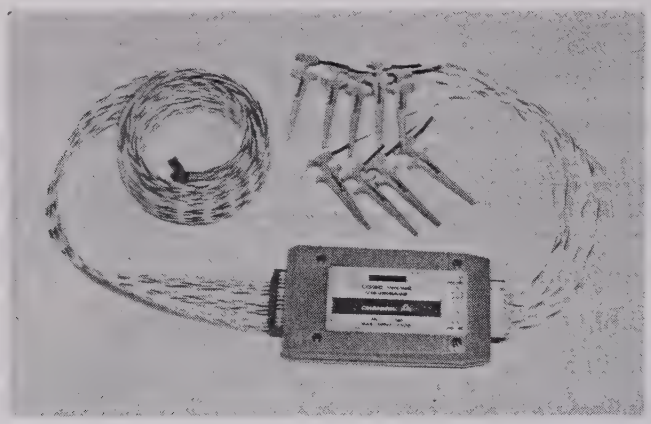


Fig. 3-2 MAIN Mode Probe

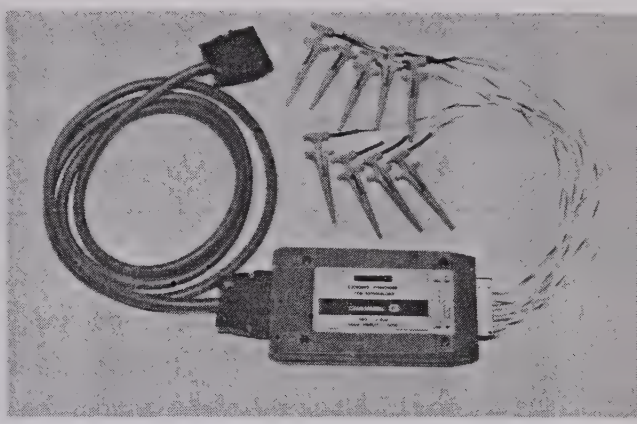


Fig. 3-3 HIGH Mode Probe

For guaranteed results, always use a round cable with a HIGH mode (100 MHz) probe ; the MAIN mode (20 MHz) cables are not designed for such high speed use.

3-9 CONNECTING PROBES

Connect the MAIN mode probes to the five connectors locataed at the rear of the instrument in the order given in Table 3-2 (henceforth, we shall refer to them by their alphabetic designation) and then make sure that they are securely in place. (see Fig. 3-4)

Probe desig.	Input connector
VQ-059A22 [A]	→ 20 MHz INPUT A
VQ-059A22 [B]	→ 20 MHz INPUT B
VQ-059A22 [C]	→ 20 MHz INPUT C
VQ-059A22 [D]	→ 20 MHz INPUT D
VQ-059A23 [E]	→ 20 MHz INPUT E

Table 3-2 MAIN Mode Probe Input Connections

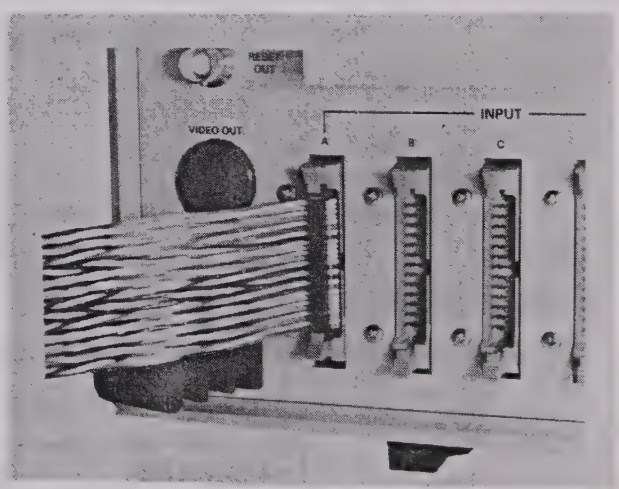


Fig. 3-4 Connecting a MAIN Mode Probe

Connect the HIGH mode probes to the three connectors located at the front of the instrument in the order given in Table 3-3 (henceforth, we shall refer to them by their alphabetic designation) and then make sure that they are securely in place. (see Fig. 3-5)

Probe disig.	Input connector
VQ-059A30 [G]	→ 100 MHz INPUT G
VQ-059A30 [H]	→ 100 MHz INPUT H
VQ-059A31 [I]	→ 100 MHz INPUT I

Table 3-3 HIGH Mode Probe Input Connections

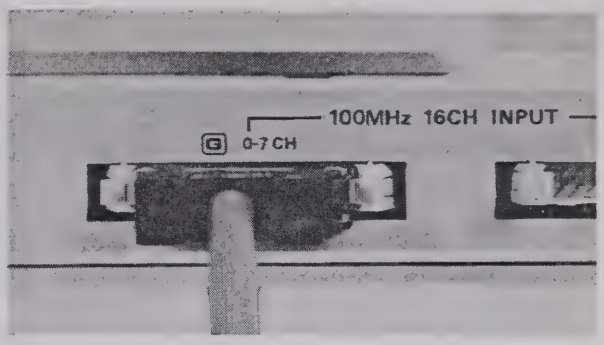


Fig. 3-5 Connecting a HIGH Mode Probe

For an accurate measurement, make sure that each probe is connected to its assigned connector

CAUTION

Each probe connector has a polarizing key to prevent incorrect connection. Check the direction and do not force the plug in incorrect direction excessive force will damage it.

Once the plug is in the connector, secure it with the locking mechanism provided.

SECTION IV
BASIC OPERATIONS

4-1 SELF-DIAGNOSIS

When the power is first applied, the VP-3662A Logic analyzer runs a diagnostic checks to see if its ROMs, RAMs, and the probes are functioning properly. If all these components pass, the screen switches to the MENU display, signifying that the instrument is ready for use. Otherwise, it will display one or more of the error messages listed below. The error light on the panel will also go on.

ROM ERROR
RAM ERROR
ERROR X PROBE (where X is the alphabetic designation of the probe that has failed)

NOTE

Make sure that the probes are not collecting input when the power is applied. Such input can cause a probe to fail the self-diagnostic test.

The most frequent cause of probe errors is improper attachment ; check the probe connection and type (that 20 MHz vs. 100 MHz). To clear the probe error message from the screen, press the MENU key (1). (This is useful, for example, when the probe causing the error is not going to be used.)

CAUTION

In all other cases (RAM/ROM error or PROBE error even though all probes are properly connected), contact your nearest Matsushita's representative.

4-2 BATTERY BACK-UP

The VP-3662A "remembers" the current parameters appearing on the MENU display even after the power has been turned off. The next time it is turned on, it will, after running through the self diagnostic checks, display exactly the same MENU specifications as when the power was turned off. This is because the C-MOS RAM where this information is stored is protected with a rechargeable battery.

Extent of protection :	100 days (max.)
Protected data :	Data set on MAIN and HIGH mode menus
Battery recharging :	Automatic--whenever AC power is applied to the instrument
Battery life :	5 years (approx.)

If the display is different—it will be the default display shown in Fig. 4-1—the battery protection has failed. Failure means that either the instrument has been left off too long or the battery has worn out. First try recharging the battery by leaving the instrument on for several hours. (Note that you can still use the instrument since the battery plays no role in taking measurements.) If that fails to fix the problem, replace the battery.

Note : Contact your nearest Matushita's representative for assistance in changing the battery.

Note

If it is desired to obtain the initialized menu display, turn on the instrument with the EDIT S key pressed and held until the self-diagnostic or menu display can be seen on the screen.

4-3 TRACE MODES

The VP-3662A Logic Analyzer provides three different trace modes, each suited to a different type of analysis. The three modes differ only in their handling of the 32 channels of MAIN mode data. The 16 channels of HIGH mode data are available at all times for separate or combined use.

(1) TRACE MODE 32ch

This synchronous mode traces all 32 channels of MAIN mode data using the clock CK1 input from Probe E. (Needless to say, the 16 channels of HIGH mode data are also available.) Typical applications include :

(a) Multi-channel synchronous measurement

(b) Monitoring microprocessor address and data bus activity while monitoring hardware activity at a higher clock rate.

(c) Synchronous measurement of up to 32 channels combined with synchronous or asynchronous measurement of 16 channels at a higher clock rate.

(d) Synchronous measurement of two systems simultaneously using separate clocks

Once the data have been stored, they can then be manipulated and displayed in various forms :

MAIN mode	STATE, TIMING, MAP 1, MAP 2
HIGH mode	STATE, TIMING

Note : The two MAP displays are limited to the 16 channels of data from MAIN mode (20 MHz) Probes D and C.

For further details, refer to paragraph 6-2 (Operation) and Section VII (Displays).

Fig. 4-1 and 4-2 show the menus for the 32ch in MAIN mode and the 16ch in HIGH mode, respectively.

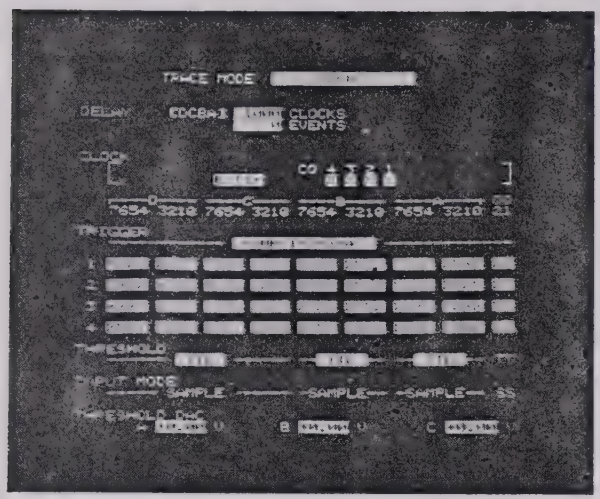


Fig. 4-1 Trace Mode = 32ch
Clock Mode = MAIN

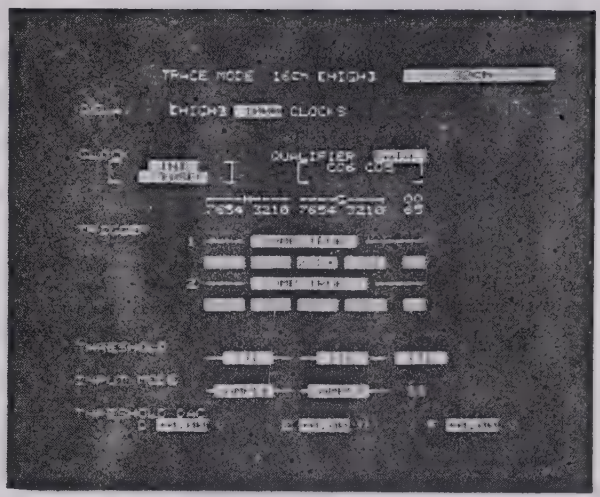


Fig. 4-2 Trace Mode = 16ch (HIGH)
Clock Mode = HIGH

(2) TRACE MODE 16ch + 16ch(1)

This trace mode (hereinafter abbreviated to "16ch(1) mode") divides the 32 MAIN mode channels into two groups of 16 each and traces one synchronously and the other, asynchronously.

(Needless to say, the 16 channels of HIGH mode data are also available.) Typical applications include :

(a) Multi-channel timing diagram display mainly for hardware analysis

(b) Multi-channel or high speed hardware analysis with smaller number of synchronous measurement channels.

(c) Hardware analysis requiring multi-channel data for monitoring general activity with the slower clock while examining details with the faster one.

Once the data have been sotred, they can then be manipulated and displayed in various forms :

MAIN mode	STATE, TIMING, MAP 1, MAP 2
HIGH mode	STATE, TIMING

Note : The two MAP displays are limited to the 16 channels of data from MAIN mode (20 MHz) Probes D and C.

The TIMING display in MAIN mode is limited to the 16 channels of data from Probes B and A.

For further details, refer to paragraph 6-3 (Operation) and Section VII (Displays).

Fig. 4-3 shows the menu for the 16ch(1) trace mode.

(3) TRACE MODE 16ch + 16ch(2)

This trace mode (hereinafter abbreviated to "16ch(2) mode") also divides the 32 MAIN mode channels into two groups of 16 each, but traces them both synchronously with separate clocks. (Needless to say, the 16 channels of HIGH mode data are also available.) Typical applications include :

(a) Synchronous measurement of three different systems simultaneously, each with its own clock

(b) Measurement of two systems with separate clocks while tracing hardware activity at higher clocks rate

Once the data have been stored, they can then be manipulated and displayed in various forms :

MAIN mode	STATE, MAP 1, MAP 2
HIGH mode	STATE, TIMING

Note : The two MAP displays are limited to the 16 channels of data from MAIN mode (20 MHz) Probes D and C.

For further details refer to paragraph 6-4 (Operation) and Section VII (Displays).

Fig. 4-4 shows the menu for the 16ch(2) trace mode.

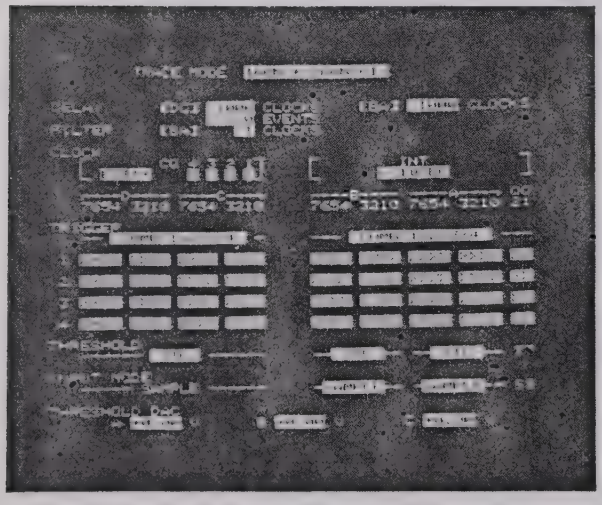


Fig. 4-3 Trace mode = 16ch(1)

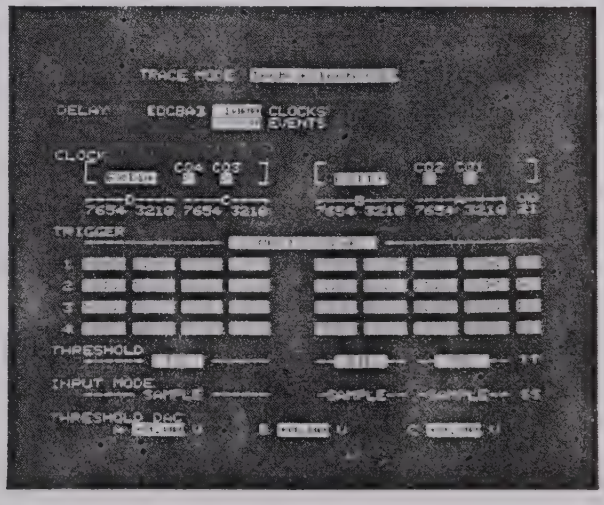


Fig. 4-4 Trace mode = 16ch(2)

4-4 OPERATION SUMMARY

For the rest of this Section, we present a step-by-step run-through of most of the controls to give the first time user some "hands on" practice. This procedure, as with most Logic Analyzer operations, uses the keys located on the front panel. Throughout this Manual, these are always cross-indexed with Fig. 10-1 on page 10-1 of this manual.

The first step, of course, is to turn on the power. If the instrument is functioning properly and the probes are all securely connected, one of the three MAIN mode menus should appear. Refer to paragraph 4-1 if an error message appears instead.

Note : This display contains the menu and parameters as specified when the instrument was last used. (see paragraph 4-2)

(1) Specifying the TRACE MODE

For example, if the instrument starts with the 32ch mode menu,

1) Pressing the EDIT key (18) starts the TRACE MODE input field blinking. (see Fig. 4-5 [1])
2) Pressing the S-key (21) changes the input field to "16ch(1)". (see Fig. 4-5 [2])
3) Pressing the S-key (21) a second time changes the input field to "16ch(2)". (see Fig. 4-5 [3])
4) Pressing the S-key (21) a third time returns the input field to "32ch", the starting point.

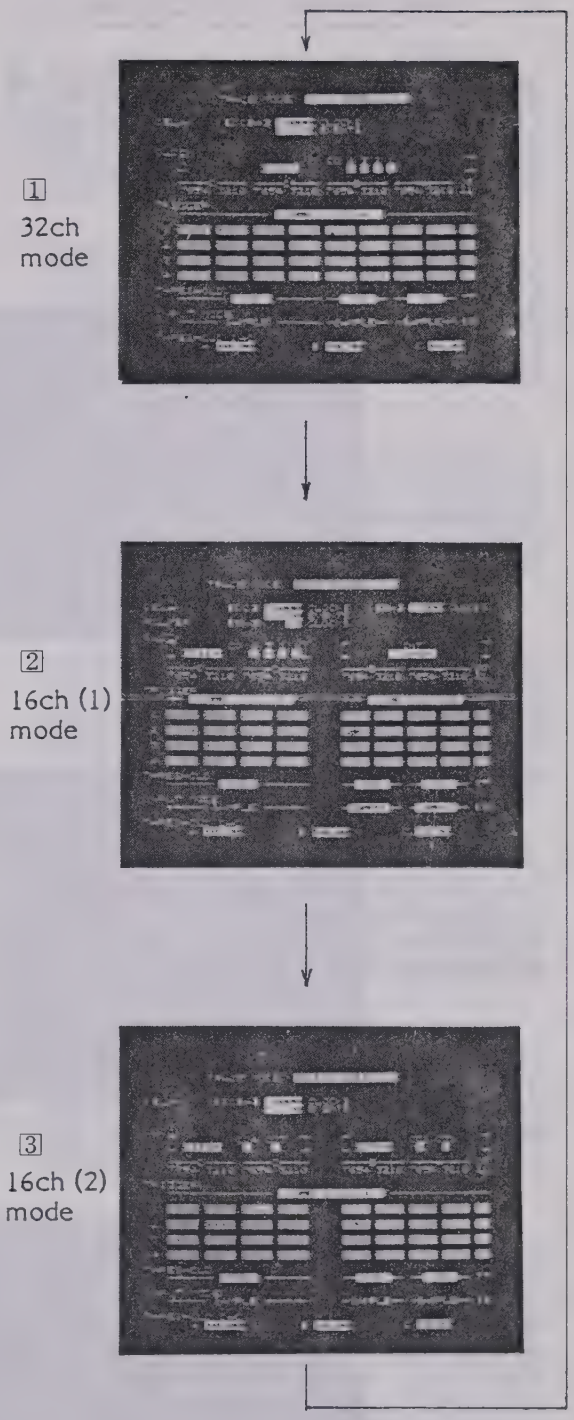


Fig. 4-5 Specifying the Trace Mode

(2) Other Menus--The MENU key ①

1) Press MENU key ① Fig. 4-6 2
2) Press MENU key ① Fig. 4-6 3
3) Press MENU key ① Fig. 4-6 1

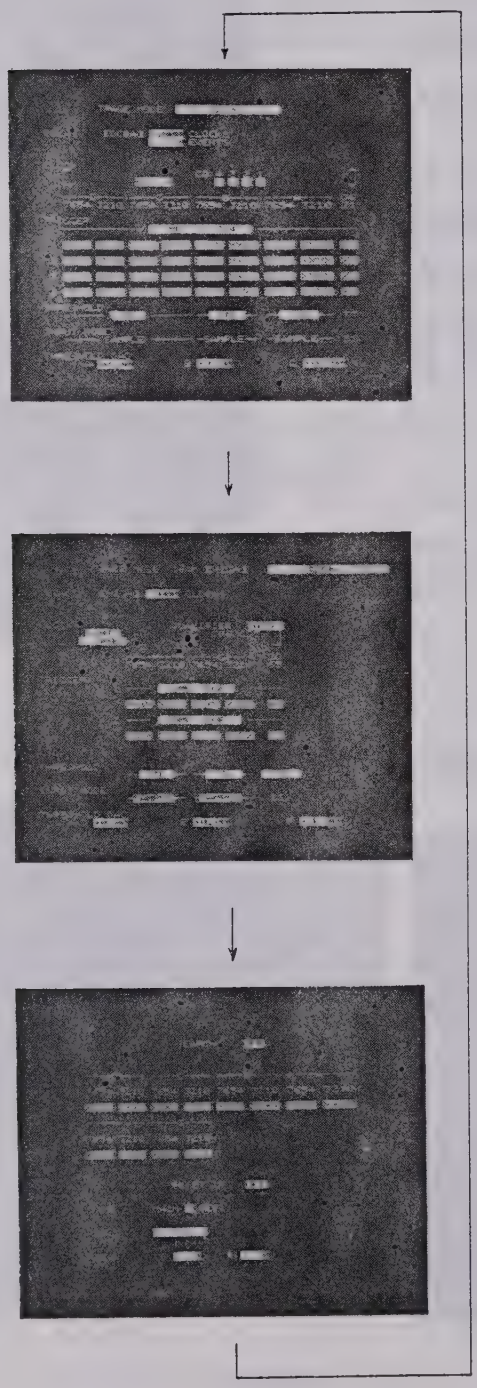
(3) Displays

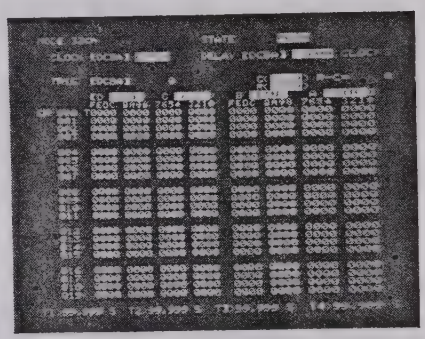
1) Press STATE key ② Fig. 4-7 1
2) Press TIMING key ③ Fig. 4-7 2
3) Press MAP key ④ Fig. 4-7 3
4) Press EDIT key ⑱
5) Press S key ㉑
6) Press MAP key ④

1
MAIN mode

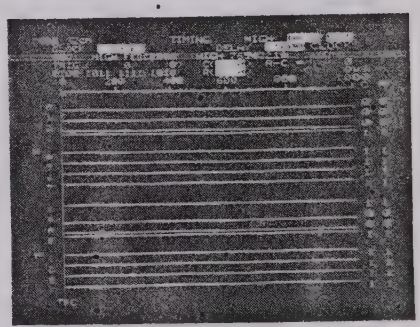
2
HIGH mode

3
SEARCH
RESET IF

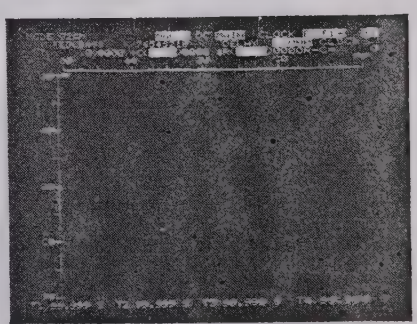




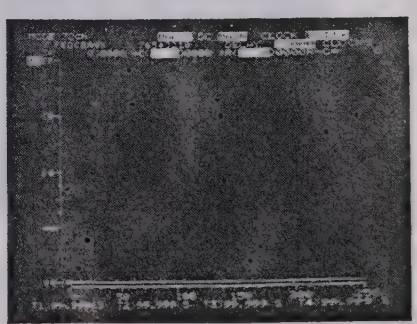
1



2



3



4

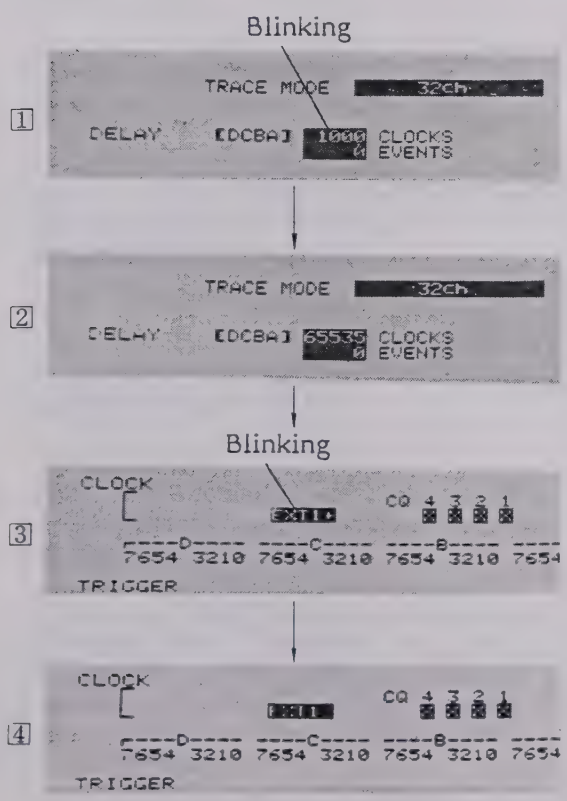
Fig. 4-6 Other Menus

Fig. 4-7 Data Displays

(4) Altering the contents of the input fields

For our last exercise, we will alter the contents of all the input fields on the 32ch menu. (return to paragraph 4-4 (1) if a diferent menu is on the screen.)

1) Press EDIT key (18) twice Fig. 4-8 [1]
2) Type the new value (max. 65,535) with the 0-9 keys (5) Fig. 4-8 [2]
3) Press EDIT key (18) twice Fig. 4-8 [3]
4) Press S key (21) Fig. 4-8 [4]
5) Press EDIT key (17) Fig. 4-8 [5]
6) Press the binary "1" key (7) Fig. 4-8 [6]
7)Press EDIT key (18) Fig. 4-8 [7]
8)Press S key (21) a few times Fig. 4-8 [8]
9) Press EDIT key (18) Fig. 4-8 [9]
10) Press the "F" hexadecimal key (5) Fig. 4-8 [10]
11) Press EDIT key (17) Fig. 4-8 [11]
12) Press the "F" hexadecimal key (5) Fig. 4-8 [12]



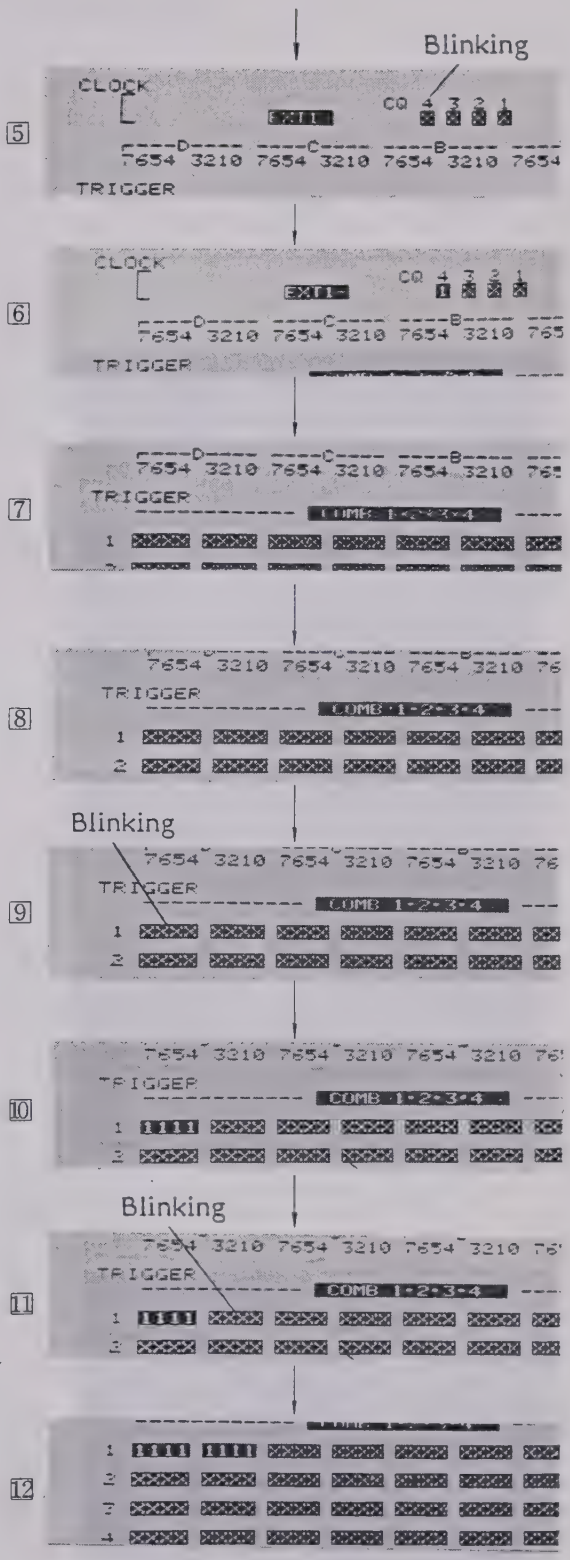


Fig. 4-8 Changing the Contents of Input Fields

SECTION V

DETAILED DESCRIPTIONS OF FUNCTIONS

This Section contains detailed description of the VP-3662A Logic Analyzer's many features and function common for all applications. Its main purpose is to better acquaint the user with instrument operations and thus help him use the Logic Analyzer more accurately and more effectively.

Note : All keys are cross-referenced with the keyboard illustration (Fig. 10-1) on page 10-1 of this manual.

5-1 BASIC PROCEDURE

(1) Summary

The measurement procedure always proceeds in the following sequence.

1) Attach the probe tips to the conductors carrying the signals to be analyzed.

2) Call up one of the three TRACE MODE menus for the MAIN mode. (Fig. 5-1 [1])

3) Specify the parameters for the input fields on this menu. (Fig. 5-1 [2])

4) Switch to the HIGH mode menu and fill in the input fields there. (Fig. 5-1 [3])

5) Press the RUN/STOP key to start the acquisition. The LED in the key will light up. (Fig. 5-1 [4])

6) When the acquisition is finished, the screen automatically displays the data for analysis. (Fig. 5-1 [5])

NOTE

Changing the contents of the TRACE MODE menu after the fourth step above can affect the HIGH mode settings as well so always follow the order just given.

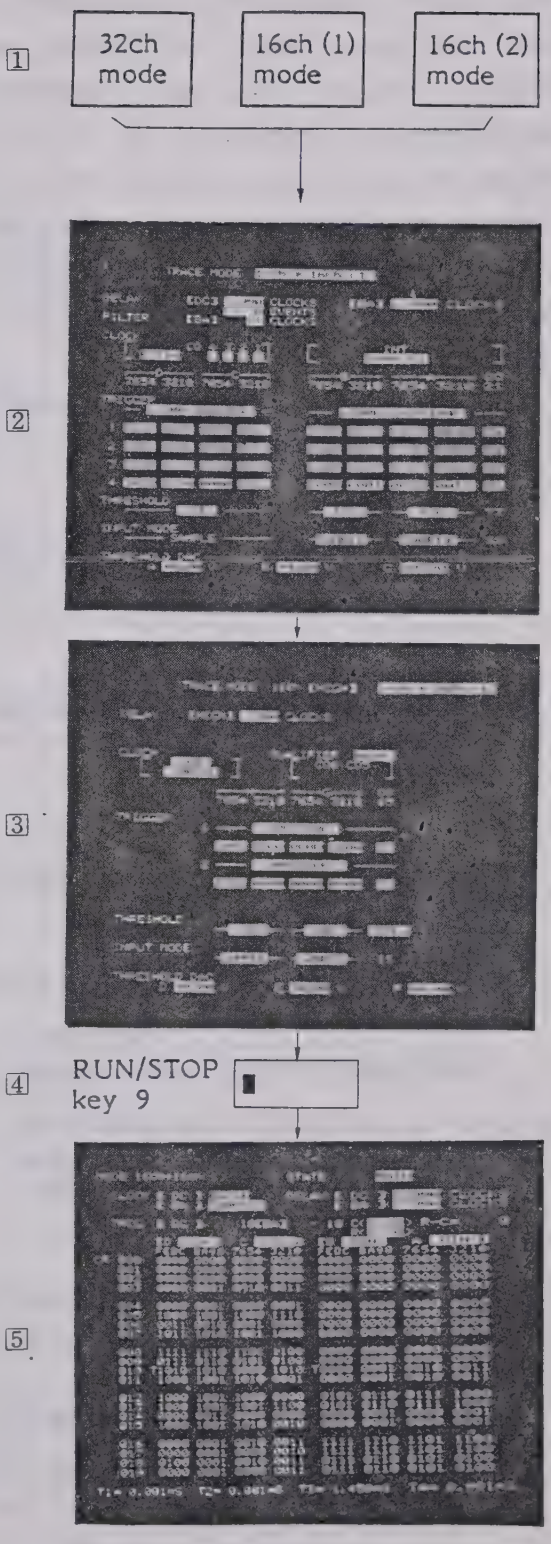


Fig. 5-1 Typical Run

(2) Changing the acquisition parameters

Changing the parameters simply involves changing the appropriate input fields on the various menu. As a matter of fact, the input fields for CLOCK and DELAY, two of the most important parameters are reproduced on the data display to speed modification so that the user can start the next run by pushing the RUN/STOP key after their modification on the data display.

Procedure

1) Call up the particular TRACE MODE menu. (Fig. 5-2 1)

2) Press one of the EDIT keys (18) or (20) to start the topmost input field blinking. (Fig. 5-2 2)

3) Use the EDIT keys (17) to (20) to shift the blinking portion among the various input fields. (Fig. 5-2 3)

4) The editing process varies between input fields. (Fig. 5-2 4)

(a) Selection with the S key (21).

TRACE MODE, CLOCK, TRIGGER, THRESHOLD, INPUT MODE

(b) Data entry with the hexadecimal keys 0-F 5 (or sometimes just the decimal subset thereof)

DELAY, FILTER, TRIGGER words 1-4, THRESHOLD DAC

(c) Data entry with the binary keys "0", "1" and X (6) - (8)

CQ, DQ, TRIGGER words 1-4

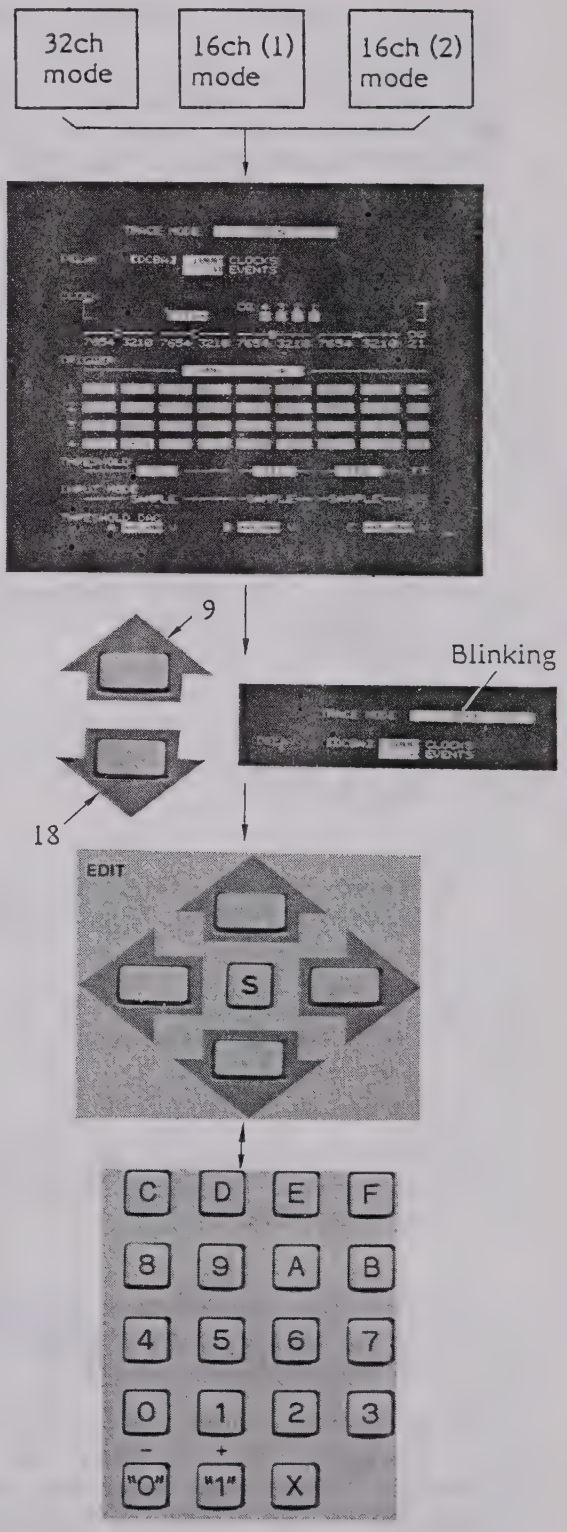


Fig. 5-2 Changing the acquisition parameters

5-2 KEYBOARD

What follows is a detailed description of the keys on the keyboard——their functions and their uses.

(1) [MENU] key (1)

Pressing the MENU key

(a) calls up the MAIN mode menu
(b) calls up the HIGH mode menu
(c) calls up the SEARCH/RESET IF menu
(d) calls up the previously used TRACE MODE menu when the initial powering up returns an error from the self-diagnostic routines

(a) Calling up the MAIN mode menu

When a STATE, TIMING, or MAP display is on the screen, pressing the MENU key calls up the MAIN mode menu.

(b) Calling up the HIGH mode menu

* Pressing the MENU key changes from the MAIN mode menu to the one for the HIGH mode.

* To go from a STATE, TIMING, or MAP display to the HIGH mode menu, press the MENU key twice.

(c) Calling up the SEARCH/RESET IF menu

* To go from the MAIN mode menu to the SEARCH/RESET IF menu, press the MENU key twice.

* To go from the HIGH mode menu to the SEARCH/RESET IF menu, press the MENU key once.

* To go from a STATE, TIMING, of MAP display to the SEARCH/RESET IF menu, press the MENU key three times. Pause between the second and third strokes to allow time for the full HIGH mode to appear.

(d) Clearing a start-up error

When the initial powering up returns an error from the self-diagnostic routines, pressing the MENU key calls up the previously used TRACE MODE menu.

CAUTION

Ignoring an error message in this way involves a certain amount of risk. (refer to paragraph 4-1)

(2) [STATE] key (2)

When the screen contains a MENU, TIMING, or MAP display, pressing this key displays the stored data in the STATE table form. If the display is already in the state table form, pressing this key registers any modification in the input fields on the data display. (For a full description of the STATE display, see paragraph 7-2)

(3) [TIMING] key (3)

When the screen contains a MENU, STATE, or MAP display, pressing this key displays the stored data in the TIMING diagram form.

NOTE

The TIMING display is only available for the 16 channels of HIGH mode data and the 16 channels of MAIN mode data from Probes B and A stored using the 16ch(1) trace mode. Up to 16 of these 32 channels can be displayed at once.

If the display is already in the timing diagram form, pressing this key registers any changes in the input fields on the data display. (For a full description of the TIMING display, see paragraph 7-3)

(4) [MAP] key (4)

When the screen contains a MENU, STATE, or TIMING display, pressing this key displays the stored data in the MAP form. There are two types of MAP displays : MAP 1 and MAP 2. They are quite different displays, designed for different applications. If the display is already in the MAP form, pressing this key registers any changes in the iput fields on the MAP display. (For a full description of the MAP displays, see paragraph 7-4)

NOTE

The MAP displays are only available for the 16 channels of MAIN mode data from Probes D and C.

(5) Hexadecimal keys [0] - [F] (5)

These keys are used for entering decimal or hexadecimal values into certain of the input fields.

* decimal ([0] - [9])

MENU display	DELAY	(0-65535)
	FILTER	(1-16)
	THRESHOLD DAC	(0-6.35)
RESET IF display	CURSORS C, R	(0-1000)
Data displays	DELAY	(0-65535)
	CURSORS C, R	(0-1000)

* hexadecimal ([0] - [F])

  MENU display ····· TRIGGER words 1 - 4

  SEARCH display ····· SEARCH words

  Data displays ····· Channel sequences

(6) Binary keys ["0"], ["1"], and [X] ⑥, ⑦, ⑧

These three keys are used :

["0"] * to set clock qualifiers (CQ, see paragraph 5-6) to "0"

* to set channel bits in the trigger word for the sequential trigger to "0"

* to give the THRESHOLD DAC input field negative polarity

* to set channel bits in the search word on the SEARCH/RESET IF menu to "0"

["1"] * to set clock qualifiers (CQ) to "1"

* to set channel bits in the trigger word for the sequential trigger to "1"

* to give the THRESHOLD DAC input field positive polarity

* to set channel bits in the search word on the SEARCH/RESET IF menu to "1"

[X] * to set clock quialifiers (CQ) to X ("Don't care")

* to set channel bits in the trigger word for the sequential trigger to X ("Don't care")

* to set channel bits in the search word on the SEARCH/RESET IF menu to X ("Don't care")

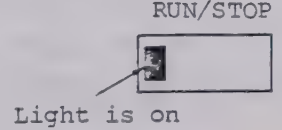
* to cancel the preceding keystroke when entering numerical values DELAY and FILTER fields on the menu, or the CURSORS C and R fields on the data display.

	0
Hexadecimal key 1	1
Hexadecimal key 2	12
Hexadecimal key 3	123
Hexadecimal key 4	1234
X key	123
X key	12

(7) [RUN/STOP] key ⑨

As the name suggests, this key starts an stops the data acquisition.

To start, press the key once. The light in it will be on to indicate that the instrument is busy inputing data.



NOTE

None of the other keys work when the light is on. To be able to use them, first press the RUN/STOP key a second time.

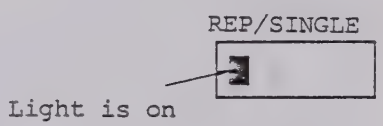
Pressing this key while the light is on forces the instrument to stop acquisition. Press this key only once. When the acquisition stops, the light will be off.

NOTE

Presing this key twice in a row will stop and then restart the acquisition.

(8) REP/SINGLE key (10)

Pressing this key sets the intrument to automatically repeat (REP=REPeat) the sequence : "acquisition", "stop", "display". When the light in the key is on, pressing the RUN/STOP key initiates the repetition.



Pressing the RUN/STOP key a second time cancels the repetition instruction, turns off the light, and returns the instrument to the SINGLE state. In the SINGLE state, the data are displayed and retained upon completion of one run.

(9) MAIN→REF key (11)

Pressing this key transfers the intire contents of the main memory into the reference memory. The main memory is for storing the acquired data ; the reference memory, for storing data for later reference. This feature enables the user to store the data from one run and compare it with that from a later one, data that will, of course, be stored in the main memory. (see paragraph 6-5 for a complete description)

NOTE

The HIGH mode does not have a reference memory. This sort of comparison is only possible with the MAIN mode.

(10) BLANK key (12)

This key controls a data-suppressing function available for the STATE and TIMING displays. When it is activated, (the light in the key will be on), pressing one of the CURSOR keys, (13) or (15), blanks out the data, a channel at a time. To restore the data, press the opposite CURSOR key, (14) or (16).

The use of the CUSORs varies with the display mode, so refer to paragraph 5-14.

(11) [CURSOR-R] keys (13), (14)

These keys have two main uses :

* controlling R-CURSOR position with the STATE, TIMING, or MAP displays.

Note : The light in the BLANK key must be off. (for more complete description, see paragraph 5-9)

* suppressing and restoring data (see the description under (10) BLANK key)

(12) [CURSOR-C] keys (15), (16)

The use of these keys varies wiht the type of display :

MENU * Shifting the blink by one channel bit in the sequential trigger input field
* Shifting the blink by one digit in the THRESHOLD DAC input field

STATE * Scrolling (see paragraph 5-10)
* Suppressing and restoring data (see (10) above)

TIMING * Shifting the position of the C-CURSOR

MAP The light in the BLANK key must be off.

Note : Pressing one of the CURSOR keys shifts the corresponding cursor one column at a time, but holding it down produces a continuous shifting at an accelerating rate.

(13) [EDIT] keys (17), (18), (19), (20)

These call up the blink and shift it about the screen. (17) and (19) have another function as well : scrolling STATE and TIMING displays one screenful at a time.

(a) Calling up the blink

Pressing (18) or (20) puts the instrument into an editing mode with the blink positioned at the uppermost input field on the screen.

(b) Shifting the blink

Presing any one of the four EDIT keys shifts the blink in the direction indicated on the panel. These controls have a "wrap-around" feature so that trying to shift the blink off the screen brings it back to the opposite end.

(c) Scrolling by page

Pressing (17) and (19) when there is no blink on the STATE or TIMING display replaces the "page" currently on the screen with an adjacent one. (see paragraph 5-11 for further details)

(14) [S] key (21)

Pressing this key changes the contents in the blinking input fields for the trace mode and acquisition conditions cyclically between the choices built into the software.

(a) Changing the TRACE mode

Pressing the EDIT keys (17) or (18) starts the top input field, TRACE MODE blinking. Strokes with the S key (21) shift the contents of this input filed in the order 32ch, 16ch(1), 16ch(2), and back to 32ch.

(b) Changing an input field

Certain input fields have only a short list of fixed choices. Shifting the blink to such a field--using the four EDIT keys (17)-(20)—and pressing the S key switches the contents automatically through the list.

(15) ERROR light

The ERROR light will be on in two distinct situations :

(a) Hardware fault

The self-diagnostic functions automatically activated when the instrument is first turned on have detected a hardware fault in RAM, ROM, or probe operation. See paragraph 4-1 for detail.

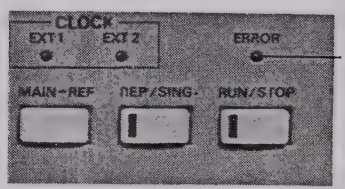


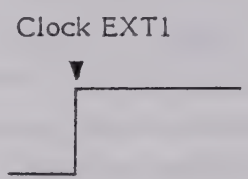
Fig. 5-3 ERROR light

(b) Invalid combination of settings

The user has specified an invalid combination of parameters and has registered them by pressing the RUN/STOP key. The instrument not only turns on the ERROR light, but also automatically enters the EDIT mode, indicating the offending parameter with the blinking. To clear the error, reset the parameters and press the RUN/STOP key.

(16) CLOCK EXT 1 light

The light flashes each time the instrument receives an external clock pulse from the EXT 1 terminal. It lights at the leading edge of the pulse and remains lit for approximately 0.2 seconds thereafter.



Leading edge—LED lights for approx 0.2 seconds

(17) CLOCK EXT 2 light

The light flashes each time the instrument receives an external clock pulse from the EXT 2 terminal. It lights at the leading edge of the pulse and remains lit for approximately 0.2 seconds thereafter.

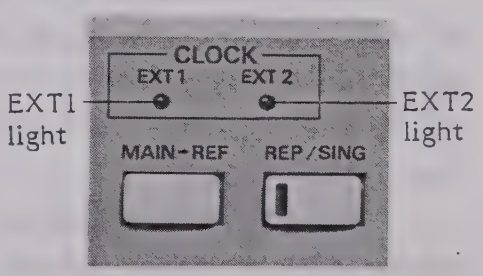


Fig. 5-4 External Clock Indicators

5-3 MENUS

The VP-3662A has a total of five menus : three MAIN mode menus, one HIGH mode menu, and the SEARCH/RESET IF menu.

(1) Displaying the Menus

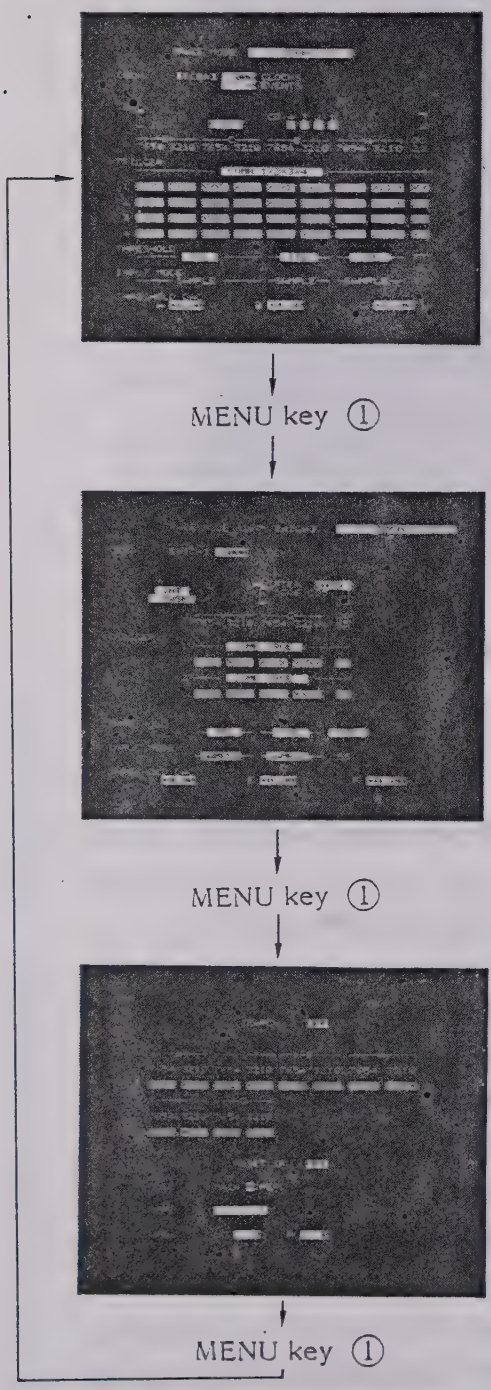


Fig. 5-5 Displaying the Menus

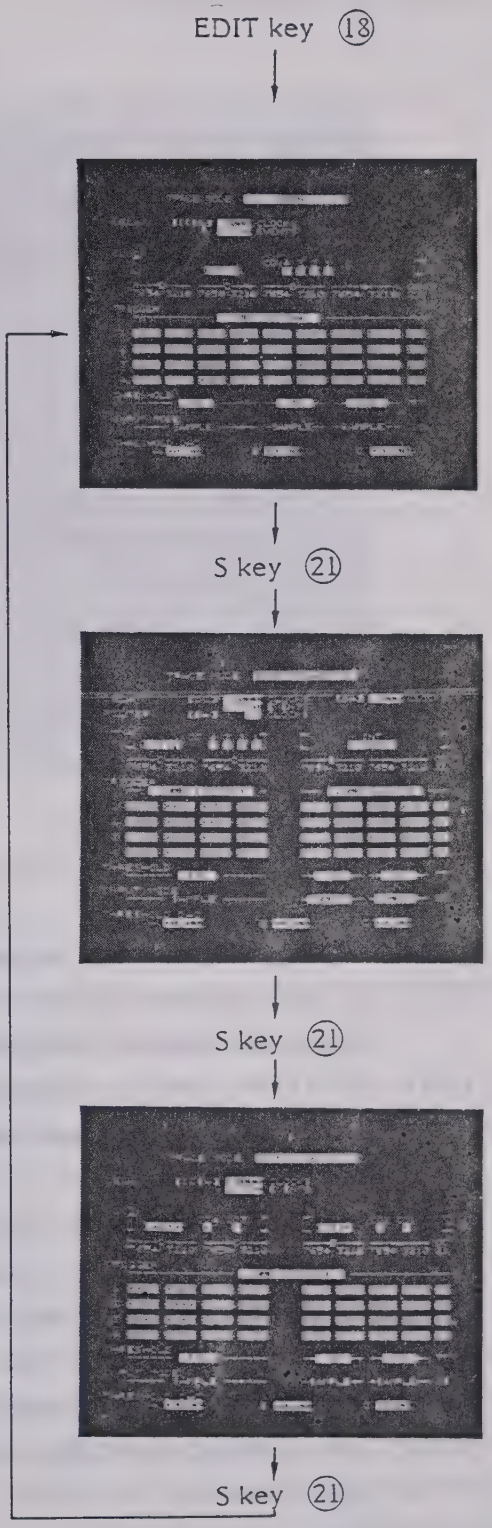


Fig. 5-6 Trace Mode Menus

(2) 32ch TRACE MODE Menu

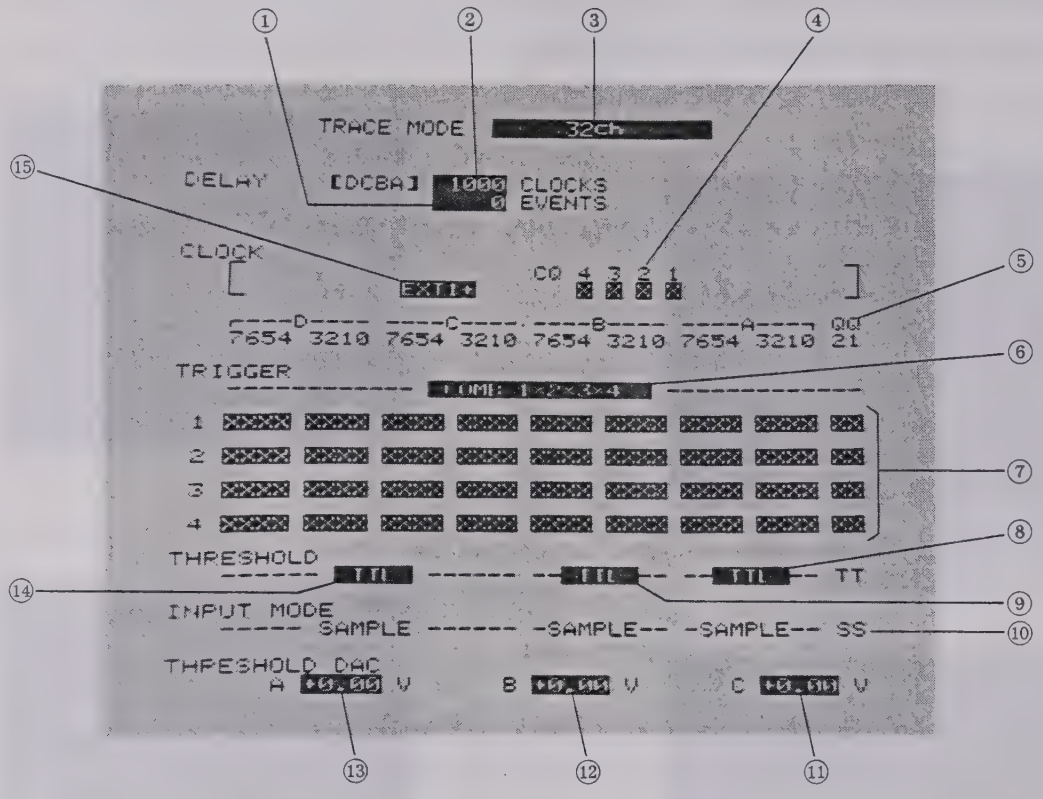


Fig. 5-7 32ch TRACE MODE Menu

③ TRACE MODE—Tells which trace mode is being used.

② CLOCK DELAY—Number of clocks to be delayed
May be set anywhere between 0 and 65535 (see paragraph 5-7)

① EVENT DELAY—Number of events to be delayed
May be set anywhere between 0 and 65535 (0 when not used)
(see paragraph 5-7)

⑮ CLOCK—Sampling clock (EXT 1+ or EXT 1-) (see paragraph 5-4)

④ CLOCK QUALIFIER—Qualifiers on sampling clock (see paragraph 5-6)

⑤ SEQUENCE—Relationship between Probe channel numbers and the trigger word

⑥ TRIGGER—Trigger pattern for Probes B and A (see paragraph 5-5)

⑦ SEQUENTIAL TRIGGER—Four-level sequential trigger words

⑭ THRESHOLD—Treshold for Probes D and C (see paragraph 5-4)

⑨ THRESHOLD—Threshold for Probe B

⑧ THRESHOLD—Threshold for Probe A

⑩ INPUT MODE—Always SAMPLE mode for this menu (see paragraph 5-4)

⑪-⑬ THRESHOLD DAC—Used when the user want a threshold other than the TTL level
(see paragraph 5-4)

(3) 16ch(1) TRACE MODE Menu

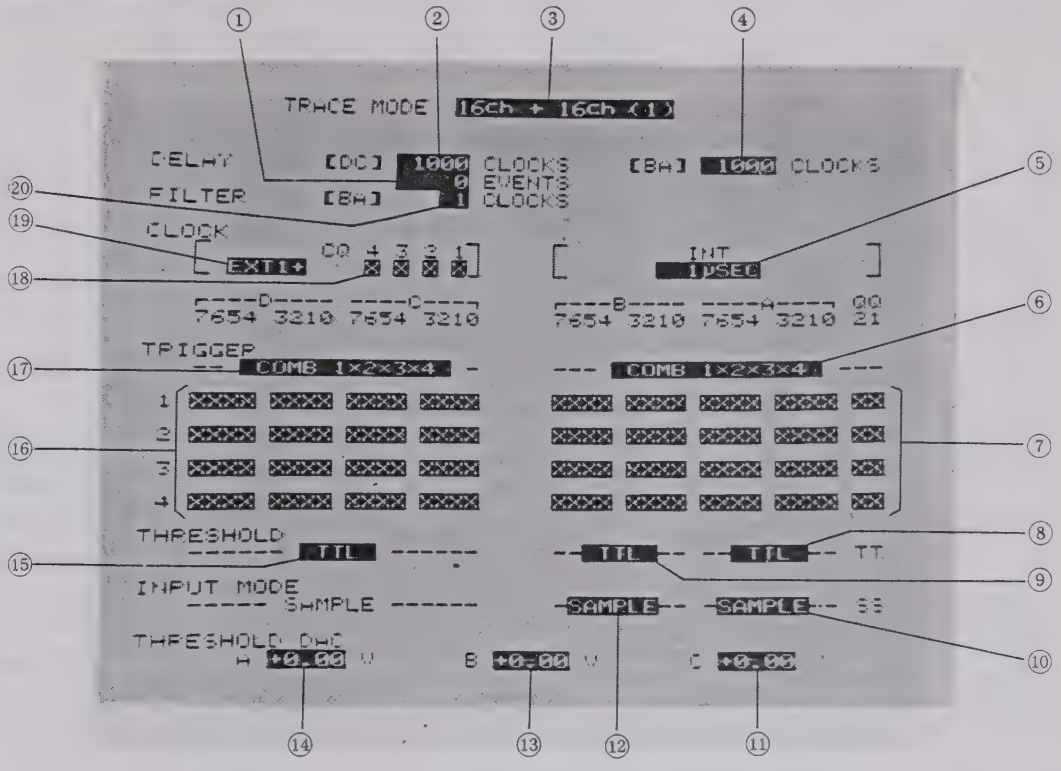


Fig. 5-8 16ch(1) TRACE MODE Menu

③ TRACE MODE

② CLOCK DELAY—Number of clocks to be delayed for Probes D and C

④ CLOCK DELAY—Number of clocks to be delayed for Probes B and A

① EVENT DELAY—Number of events to be delayed for Probes D and C

⑳ FILTER—Number of clock intervals for filter function

Note : Filter function applies to only Probes B and A

⑲ CLOCK—Sampling clock for Probes D and C (see paragraph 5-4)

⑱ CLOCK QUALIFIER—Qualifiers on sampling clock for Probes D and C

⑤ CLOCK—sampling clock for Probes B and A

⑰ TRIGGER—Pattern for Probes D and C (see paragraph 5-5)

⑥ TRIGGER—Trigger pattern for Probes B and A

⑯ SEQUENTIAL TRIGGER—Sequential trigger words for Probes D and C

⑦ SEQUENTIAL TRIGGER—Sequential trigger words for Probes B and A

⑮ THRESHOLD—Threshold for Probes D and C

⑨ THRESHOLD—Threshold for Probes B

⑧ THRESHOLD—Threshold for Probe A

⑫ INPUT MODE—Input mode for Probe B

⑩ INPUT MODE—Input mode for Probe A

(4) 16ch(2) TRACE MODE Menu

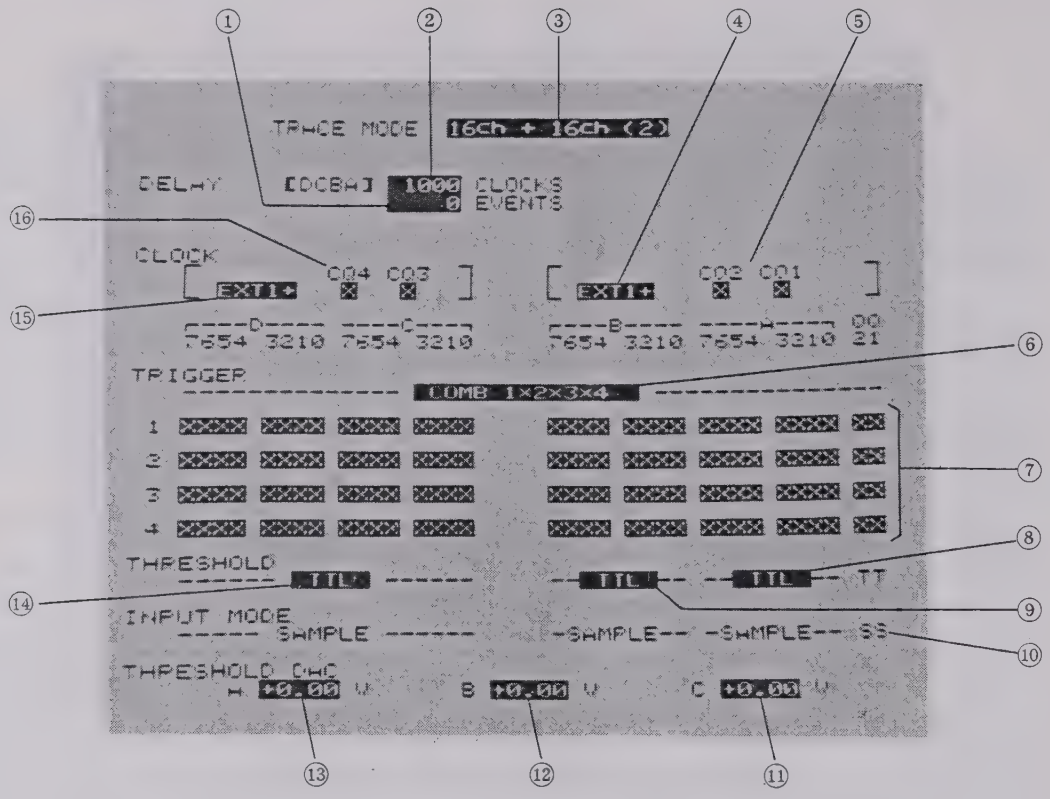


Fig. 5-9 16ch(2) TRACE MODE Menu

(3) TRACE MODE
(2) CLOCK DELAY—Number of clocks to be delayed
(1) EVENT DELAY—Number of events to be delayed
(15) CLOCK—Sampling clock for Probes D and C
(16) CLOCK QUALIFIER—Qualifiers on sampling clock for Probes D and C
(4) CLOCK—Sampling clock for Probes B and A
(5) CLOCK QUALIFIER—Qualifiers on sampling clock for Probes B and A
(6) TRIGGER—Trigger pattern for Probes D through A
(7) SEQUENTIAL TRIGGER—Four-level sequential trigger words
(14) THRESHOLD—Threshold for Probes D and C
(9) THRESHOLD—Threshold for Probe B
(8) THRESHOLD—Threshold for Probe A
(10) INPUT MODE—Always SAMPLE mode for this menu
(11)-(13) THRESHOLD DAC—Used when the user want a threshold other than the TTL level

(5) HIGH mode menu

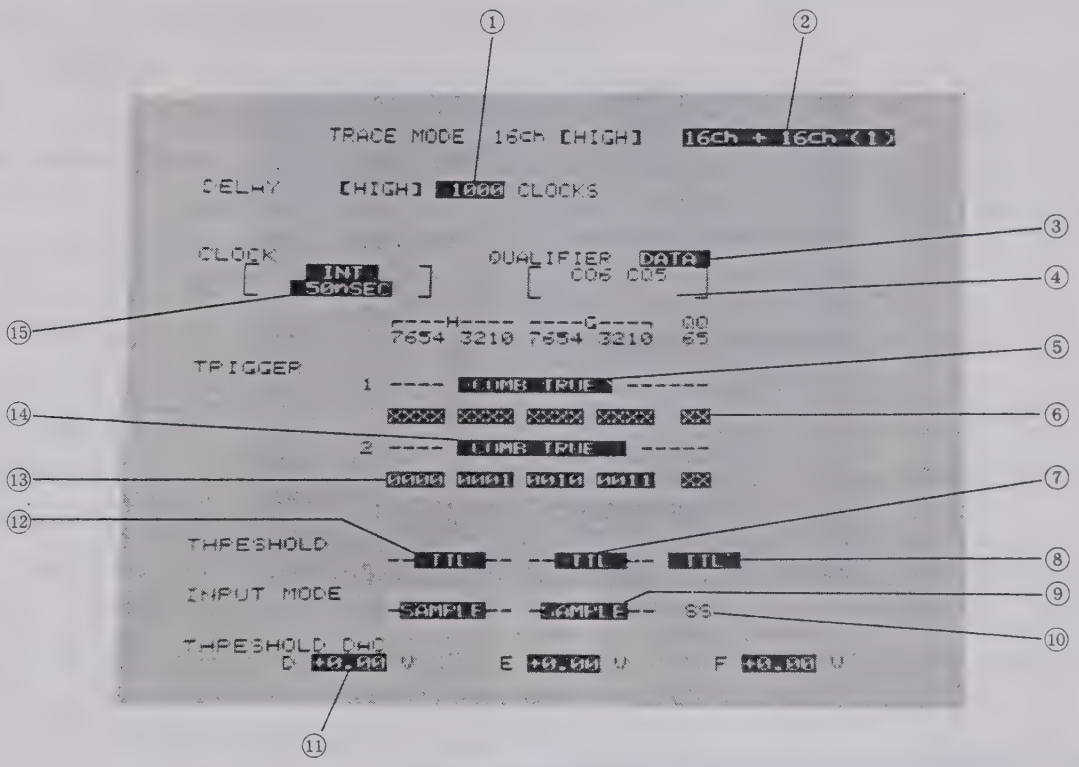


Fig. 5-10 HIGH mode TRACE MODE Menu

(2) TRACE MODE—Trace mode for the MAIN mode
(1) CLOCK DELAY—Number of clocks to be delayed
(15) CLOCK—Sampling clock (Internal or external)
(3) QUALIFIER—Type of qualifiers being used (DATA or CLOCK)
(4) CLOCK QUALIFIER—Qualifiers on sampling clock if one used
(5) TRIGGER 1—Trigger pattern for Sequential trigger level 1
(14) TRIGGER 2—Trigger pattern for Sequential trigger level 2
(6) TRIGGER WORD—Trigger words for Sequential trigger level 1
(13) TRIGGER WORD—Trigger words for Sequential trigger level 2
(12) THRESHOLD—Threshold for Probe H
(7) THRESHOLD—Threshold for Probe G
(8) THRESHOLD—Threshold for Probe I
(11) INPUT MODE—Inpu mode for Probe H
(9) INPUT MODE—Input mode for Probe G
(10) INPUT MODE—Input mode for Probe I

(6) SEARCH/RESET IF menu

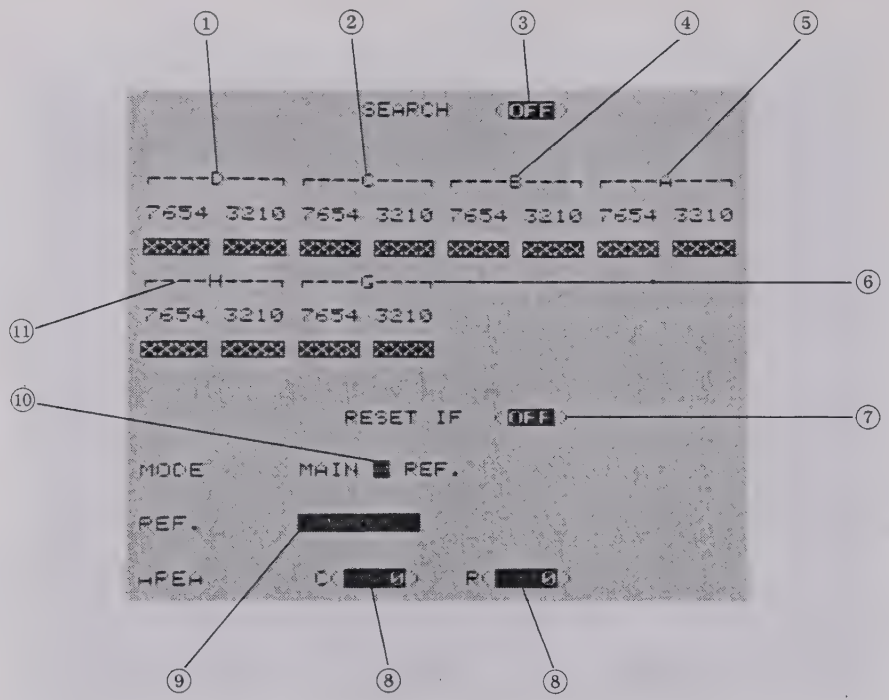


Fig. 5-11 SEARCH/RESET IF Menu

(3) SEARCH—When this input field is set to ON, the instrument is searching through the stored data.

(1) D—Data specification for Probe D data

(2) C—Data specification for Probe C data

(4) B—Data specification for Probe B data

(5) A—Data specification for Probe A data

(11) H—Data specification for Probe H data

(6) G—Data specification for Probe G data

RESET IF

(7) RESET IF—This input field changes to ON when the RESET IF function is in operation.

(10) MODE—Truth value for comparison function (EQUAL or NOT EQUAL)

(9) REF (reference)—Specifies the reference data to be compared

(8) AREA—Memory pointers to the first and last data addresses to be compared

5-4 INPUT

What follows is a description of the functions and settings required to get accurate data acquisition for the VP-3662A Logic Analyzer.

(1) Probes

There are two major types of probes : the MAIN mode ones and the HIGH mode ones. They cannot be used interchangeably. The five MAIN mode probes and the two Model VQ-059A30 probes (G and H) are interchangeable within their groups, but using them as marked makes identification of channels much easier.

NOTE

Confusing MAIN and HIGH mode probes endangers not only the probes, but the Logic Analyzer as well. Always make sure that they are used properly.

Using a HIGH mode cable would do no deterioration to a MAIN mode performance, but the reverse is not true. The results from HIGH mode probes connected with MAIN mode cables are not guaranteed.

Similarly, HIGH mode probe tips (20 cm long) may be used with MAIN mode probes without impairing the latter's operating characteristics, but the reverse (using the 30 cm long MAIN probes with HIGH mode probes) cuts the Logic Analyzer's highest possible speed down to 20 MHz.

NOTES

When using an external clock with a frequency of 10 MHz or above, make sure that the clock lead from the probe tip is twisted together with its ground lead.

The connector for probe tips are polarized to prevent connection in incorrect direction, but always make sure that they have been connected properly. (see Figures 5-12 to 5-14)

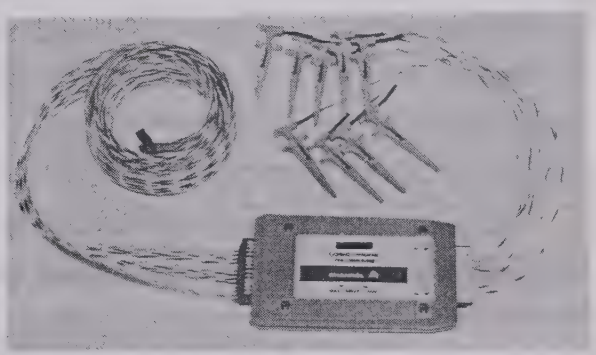


Fig. 5-12 MAIN mode Probe

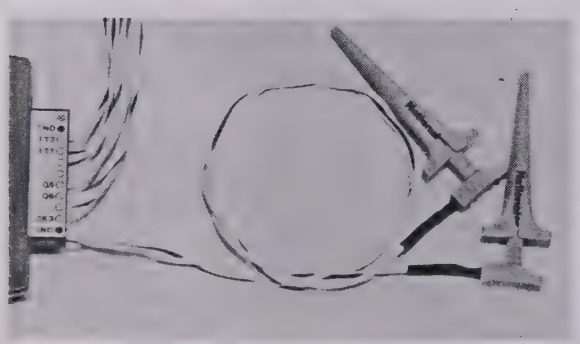


Fig. 5-13 Twisted Pair

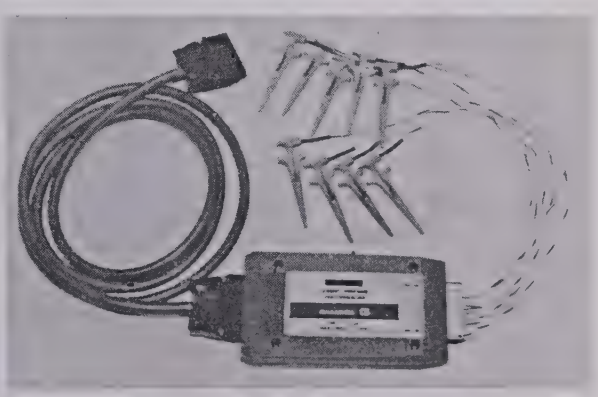


Fig. 5-14 HIGH mode Probe

(2) Probe errors

When the power is first applied, the Logic Analyzer runs diagnostic tests on the probes. (see paragraph 4-1) A "PROBE ERROR" message at the end of these tests can mean:

(a) The probe cable is not firmly connected to the probe case.

(b) The probe cable is not firmly connected to the socket on the instrument.

(c) MAIN and HIGH probes have been interchanged.

(d) The probe is already receiving data.

(e) There is a defect inside the probe case.

(f) There is a break or short circuit in the probe cable.

(g) There is a fault in the instrument.

Of these, the user can check the designated probes for (a) through (d). (d) is especially important since signals entering a probe tip can—depending on their amplitude, or speed---Trigger an error. There are several ways to block this kind of error :

(a) leave the probe tips unconnected

(b) cut the power to the system under test

(c) disconnect the probe tips from the probe case

(d) ground all probe tips

NOTE

If repeated checks rule out the possibility of cases (a) through (d), then the error is probably due to one of cases (e) through (f), cases that require servicing by an authorized Matushita's representative.

All probes are labeled with letters of the alphabet to simplify the task of channel indentification. We therefore recommend that you always use them as labeled. However, should one fail, as an emergency measure, you can substitute another, as long as the substitute comes from the same compatibility group. (see Table 5-1)

MAIN mode Probes	VQ-059A22 [A]	These are interchangeable
	VQ-059A22 [B]	
	VQ-059A22 [C]	
	VQ-059A22 [D]	
	VQ-059A23 [E]	
HIGH mode Probes	VQ-059A30 [G]	These are interchangeable
	VQ-059A30 [H]	
	VQ-059A31 [I]	Not interchangeable

Pressing the MENU key clears the PROBE ERROR message from the screen.

(3) Probes and trace modes

The VP-3662A provides three different trace modes :

(a) 32ch mode

(b) 16ch(1) mode

(c) 16ch(2) mode

each with its own particular way of data acquisition (see Table 5-2) and its own particular applications. The letters A-E and G-I in Table 5-2 refer to the connection sockets on the rear and front of the instrument, respectively. (see paragraph 3-7 for the connection method and Section VI for descriptions of the three trace modes)

Table 5-2 Probes and Trace Modes

	PROBES	32ch mode	16ch (1) mode	16 ch (2) mode
MAIN mode	VQ-059A22 A VQ-059A22 B VQ-059A22 C VQ-059A22 D	EXT CK 1	INT CK 50ns - 50ms	EXT CK 1, 2
			EXT CK 1	EXT CK 1
	VQ-059A23 E	EXT CK 1, EXT CK 2, DQ 1, 2, CQ 4-1		
HIGH mode	VQ-059A30 G VQ-059A30 H	INT CK 10ns - 50ms EXT CK 3		
	VQ-059A31 I	EXT CK 3, QUALIFIER 5, 6, EXT TRIGGER T1, T2		

Fig. 5-15 illustrates how the MAIN mode data entering through sockets D to A appear on the menu display.

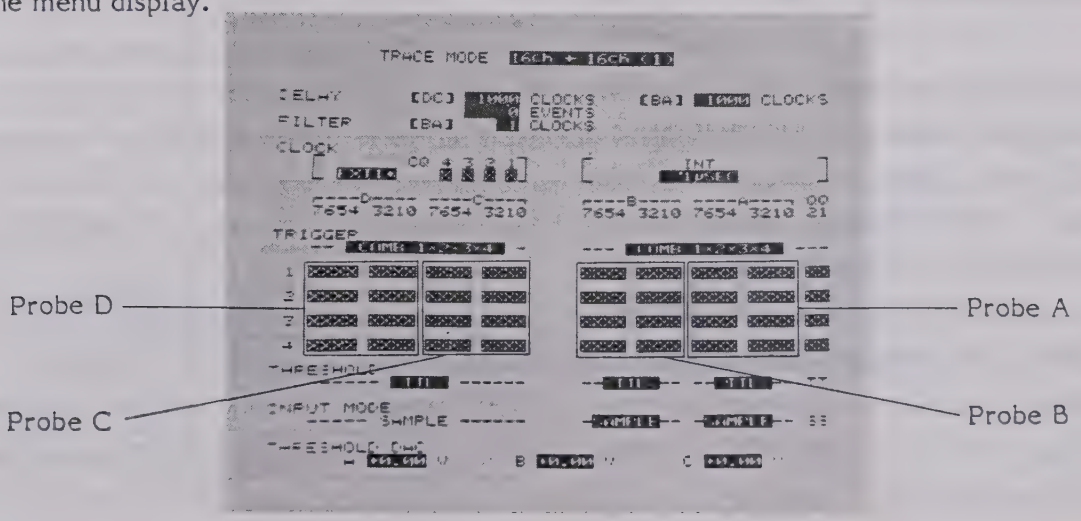


Fig. 5-15 MAIN Mode Probes and the Menu Display

Fig. 5-16 illustrates how the HIGH mode data entering through sockets H and G appear on the menu display.

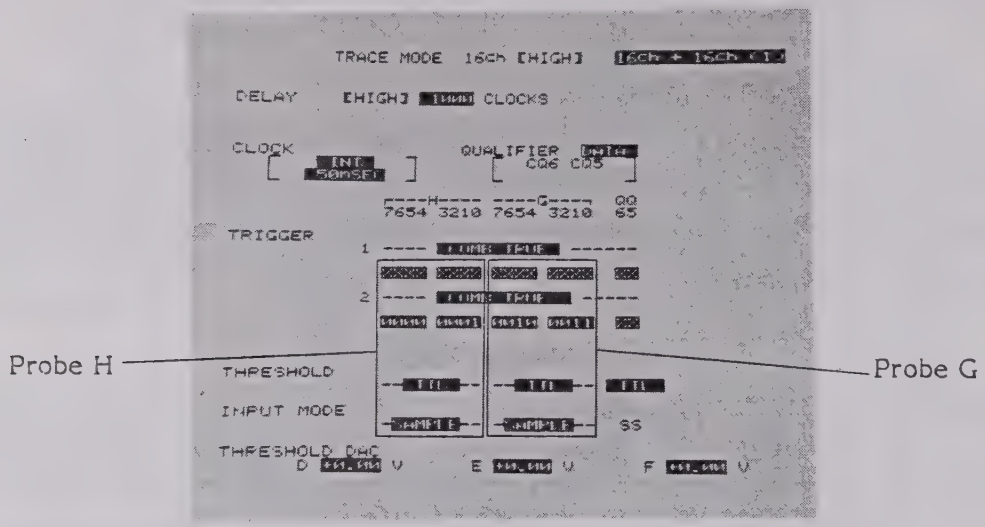


Fig. 5-16 MAIN Mode Probes and the Menu Display

(4) THRESHOLD VOLTAGE

The threshold voltage is the probe's reference point for distinguishing whether the input is a "0" or a "1". Available are :

MAIN mode : TTL, DAC A, DAC B, DAC C

HIGH mode : TTL, DAC D, DAC E, DAC F

The TTL setting, fixed at 1.4 V, is designed for testing transistor-transistor logic integrated circuits. Most TTL ICs now use 2.4 V for HIGH and 0.4 V for LOW, so 1.4 V represents the mean.

The other settings, DAC A-F, are for use with other types of circuit logic--for example, emitter-coupled logic (ECL). Variable, they may be set anywhere between -6.35 V and +6.35 V, in increments of 50 mV.

These settings are summarized in Table 5-3.

	PRODES	CHANNEL	THRESHOLD VOLTAGE
MAIN mode	Probe D Probe C	0 ~ 7	TTL, DAC A ~ C
	Probe B	0 ~ 7	TTL, DAC A ~ C
	Probe A	0 ~ 7	TTL, DAC A ~ C
	Probe E	CK 1 CQ 4, 3	TTL, DAC A ~ C
		CK 2 CQ 2, 1 DQ 2, 1	TTL, DAC A ~ C
HIGH mode	Probe G	0 ~ 7	TTL, DAC D ~ F
	Probe H	0 ~ 7	TTL, DAC D ~ F
	Probe I	EXT CK QUAL.	TTL, DAC D ~ F

Table 5-3 Threshold Voltage Settings

Fig. 5-17 shows how the threshold settings appear on the MAIN mode menu display.

① Threshold for Probe A
② Threshold for data qualifiers DQ2 and DQ1
③ Threshold for Probe B
④ Threshold for Probes D and C

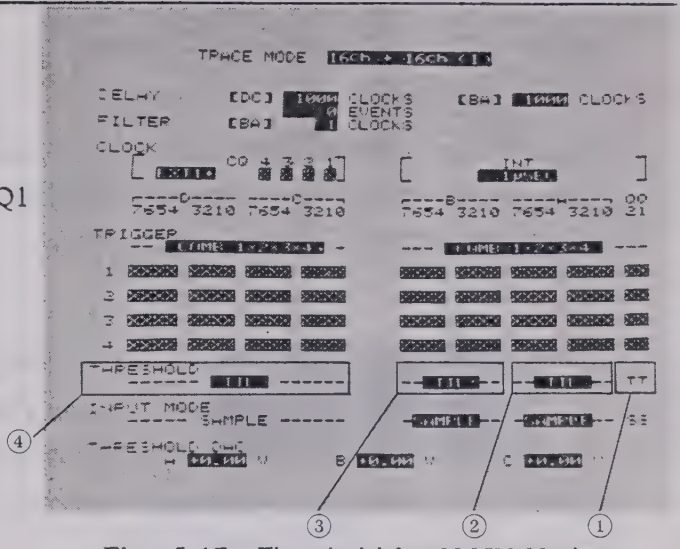


Fig. 5-17 Threshold for MAIN Mode

Fig. 5-18 shows how the threshold settings appear on the HIGH mode menu display.

① Threshold for Probe I
② Threshold for Probe G
③ Threshold for Probe H

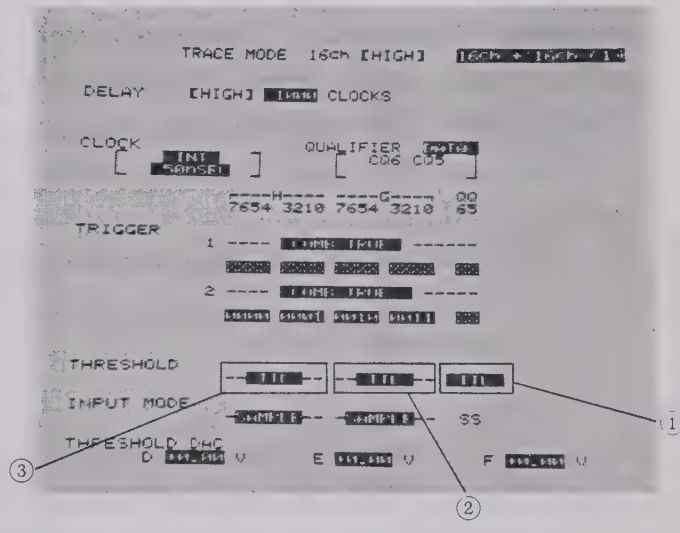


Fig. 5-18 Threshold for HIGH Mode

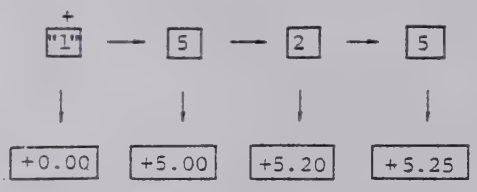
Setting the Threshold Voltage

The threshold voltage is set just like any other input field : use the EDIT keys ⑰ -⑳ to activate the blink and shift it to the threshold voltage input field. Then use the EDIT S key to switch the contents. Any setting other than TTL requires a numerical setting in the corresponding THRESHOLD DAC input field.

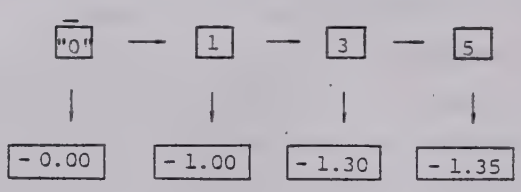
Setting the THRESHOLD DAC Voltage

At the bottom of the meny display are three THRESHOLD DAC input fiels (Labeled A, B, and C on the MAIN mode menu ; D, E, and F on the HIGH mode menu) containing three reference foltage levels. Use the binary keys "0" ("-") and "1" ("+") to specify the sign and the decimal keys to enter the three digits of the value. (The decimal point is automatically inserted.)

Example 1: Threshold voltage of +5.25 V



Example 2: Threhsold voltage of -1.35 V

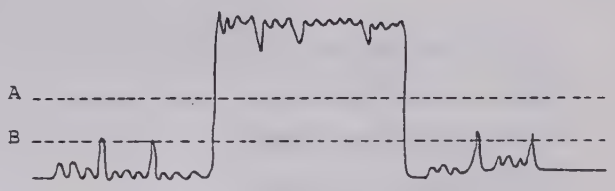


NOTE

The maximum magnitude is 6.35 ; any attempt for higher setting is ignored.
Settings are in increments of 0.05 V so the last digit must be 0 or 5.

An application of the THRESHOLD DAC

This function can improve the noise immunity. For example, if the output from a TTL IC contains noise, changing the THRESHOLD DAC level tells the circuitry to either ignore or record the noise peaks. (see Fig. 5-19)



(1) Acquired data with threshold level A

(2) Acquired data with threshold level B

Fig. 5-19 Using THRESHOLD DAC

Minimum Swing

The minimum swing required, relative to the threshold voltage, for probe input is 0.4 V ; any signals inside the 0.8 V transition band centered on the threshold voltage may be ignored.

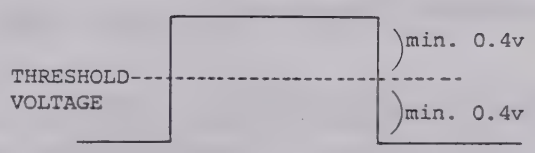


Fig. 5-20 Minimum Swing

(5) Clocks

(a) Internal clocks (INT)

The Logic Analyzer contains two independently operating internal clock cirucits. Figures 5-21 and 5-22 show the clock input fields for the MAIN and HIGH mode displays, respectively.

Fig. 5-21 MAIN Mode Clock Input Field

Fig. 5-22 HIGH Mode CLock Input Field

Operating range

MAIN mode : 50 ns - 50 ms

HIGH mode : 10 ns - 50 ms

A setting outside the range produces an ERROR message when the RUN/STOP key is pressed. Correct the setting before proceeding.

The internal clock is only available for

HIGH mode : Probes H and G

MAIN mode : Probes B and A in the 16ch(1) trace mode

Setting the clock interval

The CLOCK is set just like any other input field : use the EDIT keys (17) - (20) to activate the blink and shift it to the CLOCK input field. Then use the EDIT S key to switch the contents. (This field treats the numbers and the units separately.)

The input field will accept clock interval settings even if they are out of range. Then, when the RUN/STOP key is pressed it will return an ERROR message, activate the blink, and place over the offending CLOCK input field. The user must correct the setting before proceeding.

Sampling clock vs. observation time

The VP-3662A has a memory capacity only 1001 bits per channel. Therefore, the maximum time interval that can be observed at one time is 1000 times the clock interval. For example, if the clock interval is 1 μs, the observation time is 1 ms.

(b) External clocks (EXT CK)

All other acquisition operations use external clocks. The Logic Analyzer has provisions for up to three external clocks : two for the MAIN mode and one for the HIGH mode. Figures 5-23 and 5-24 show how external clock specifications appear in the CLOCK input fields on the MAIN and HIGH mode displays.

Fig. 5-23 CLOCK Input Field (MAIN mode)

Fig. 5-24 CLOCK Input Field (HIGH mode)

Table 5-4 summarizes which of the two external clocks (CK1 and CK2) each pair of probes can use in each of the three trace modes.

Table 5-4 External Clocks

Trace Mode	32ch	16ch(1)	16ch(2)
Probes D and C	CK1	CK1	CK1
Probes B and A	CK1	None	CK1 or CK2

Note Only the CK3 clock from Probe I is available for the HIGH mode.

The Logic Analyzer expects to find the external clock inputs on the following channels : (see also Figures 5-25 and 5-26)

CK1 CK1 on Probe E
CK2 CK2 on Probe E
CK3 CK3 on Probe I

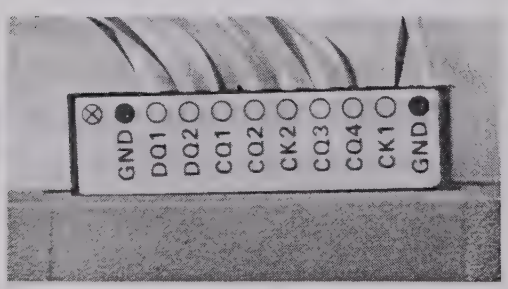


Fig. 5-25 External Clocks CK1 and CK2

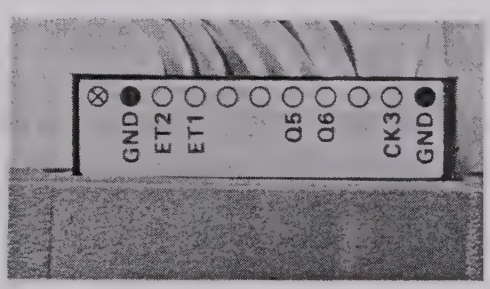


Fig. 5-26 External Clock CK3

NOTE

When using an external clock of 10 MHz or higher, make sure that the clock lead from the probe tip is twisted into a pair with the probe tip's ground lead. (see Fig. 5-13 in paragraph 5-5 (1))

Specifying an external clock

The external clock is set through the CLOCK input field : use the EDIT keys (17) - (20) to activate the blink and shift it to the CLOCK input field. Then use the EDIT S key to switch the contents. (Fig. 5-27 shows how the external clock specification appears on the HIGH mode display.)

Fig. 5-27 External Clock (HIGH Mode)

Data acquisition with an external clock

The VP-3662A uses the leading (+) or trailing (-) edge of the specified clock signal to sample the incoming data. This can produce quite different results. (see fig. 5-28)

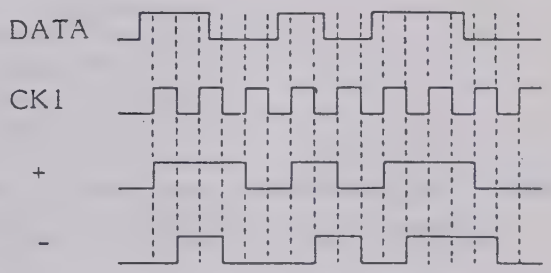


Fig. 5-28 Sampling with an External Clock

Set-up time and hold time

To ensure accurate sampling, the clock edge and the data must stand in a certain timing relationship, normally expressed through two parameters called the "set-up time" , t_s , and the "hold time" , t_h.

The VP-3662A can only be used with data and clocks satisfying its set-up and hold time requirements.

MAIN mode	20 ns
HIGH mode	0 ns

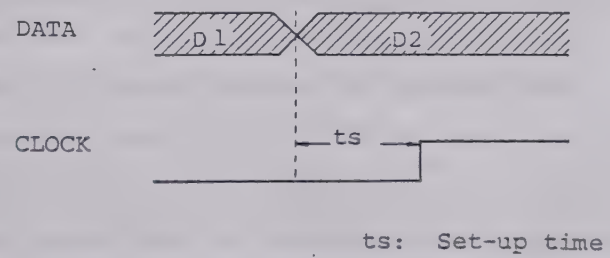


Fig. 5-29 Set-Up Time

The interval between the start of data item D_2 and the next sampling edge (in Fig. 5-29, it is the rising edge of the clock signal), t_s , must exceed the instrument's set-up time rating. Otherwise, the data may be lost.

Ratings	Set-up time
MAIN mode	20 ns
HIGH mode	0 ns

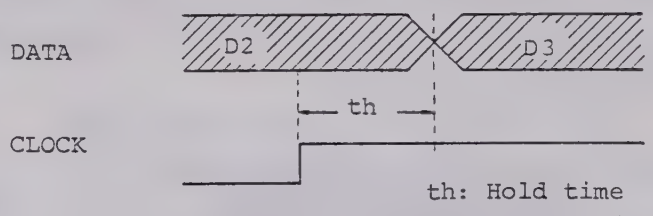


Fig. 5-30 Hold Time

The interval between the sampling edge (in fig. 5-30, it is the rising edge of the clock signal), t_h , and the end of data item D_2 must exceed the instrument's hold time rating. Otherwise, the data may be lost.

Ratings	Hold time
MAIN mode	0 ns
HIGH mode	5 ns

Note : The illustrations above used the leading edge of the clock signal to define these two terms, but they could just as well have used the trailing edge.

(6) INPUT MODE

The VP-3662A Logic Analyzer provides two input modes, SAMPLE and LATCH.

(a) SAMPLE

This mode only records the data as it is when the instrument detects the clock edge and, in effect, ignores any changes in between. It is used primarily for microprocessor and other synchronous applications.

(b) LATCH

In the absence of glitches*, this mode behaves exactly like the other one. When it detects a glitch, however, it retains the glitch and records it as the input for the next clock edge.

It is used primarily for hardware malfunction analysis.

Fig. 5-31 shows the INPUT MODE input field for the MAIN mode menu display.

* A glitch is normally defined as a sharp noise pulse of short duration, but we shall use the word to describe any noise pulse of duration less than the sampling interval.

Sampling with an external clock automatically requires the SAMPLE mode. LATCH requires an internal clock. As a result, it can only be used with HIGH mode Probes H and G and MAIN mode Probes B and A in the 16ch(1) trace mode

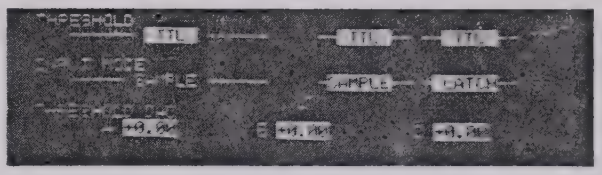


Fig. 5-31 INPUT MODE

Changing the INPUT MODE

The INPUT MODE is set just like any other input field : use the EDIT keys (17)-(20) to activate the blink and shift it to the INPUT MODE input field. Then use the EDIT S key to switch the contents between SAMPLE and LATCH.

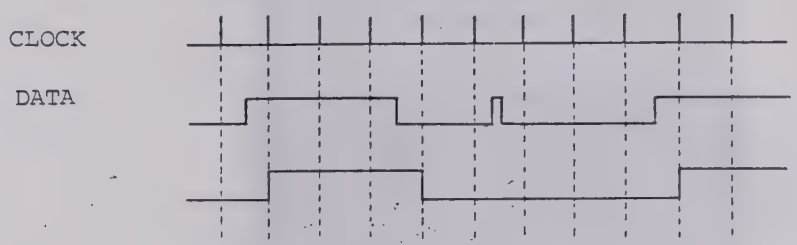


Fig. 5-32 SAMPLE INPUT Mode

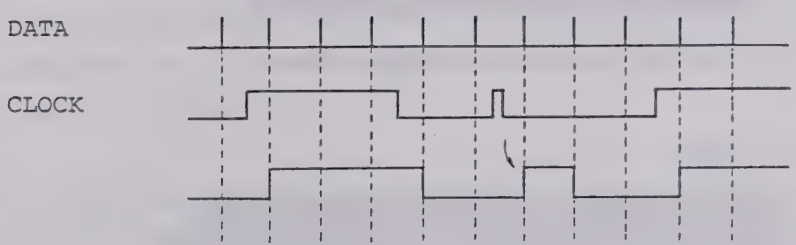


Fig. 5-33 LATCH INPUT Mode

5-5 TRIGGERING

The trigger function automatically scans the incoming stream of data for a specified pattern, then stops the trace so that the user can examine the stored data. The VP-3662A offers a full range of trigger functions for both hardware and software applications.

(1) SEQUENTIAL TRIGGER

The MAIN mode sequential trigger has four levels. The instrument does not display the stored data until it has received data satisfying all four requirements expressed by the trigger words.

Note : Using the GLITCH trigger for Probes B and A automatilcally reduces (to 1) the number of trigger levels available.

Setting the sequential trigger

1. Use the EDIT keys (17) - (20) to activate the blink and shift it to the sequential trigger input field (1 in Fig. 5-34).
2. Use the EDIT S key to switch the contents to the desired trigger conditions.
3. Use EDIT key (18) to shift the blink to the trigger word input field (2 in Fig. 5-34).
4. Enter the trigger word in hexadecimal or binary.
5. Repeat for the remaining trigger word input fields.

The blink in the trigger word input fields can be shifted in two ways :

With EDIT keys (17) - (19) skip to head of adjacent 4-bit field

With CURSOR C keys (15) - (16) skip to adjacent bit

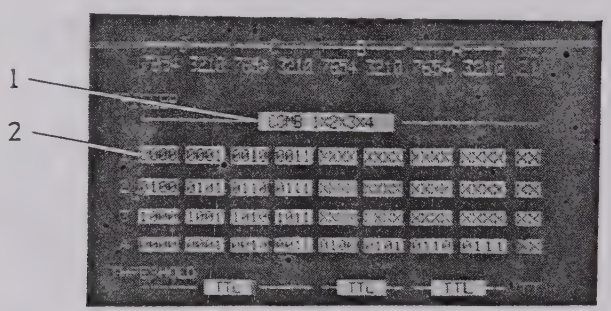
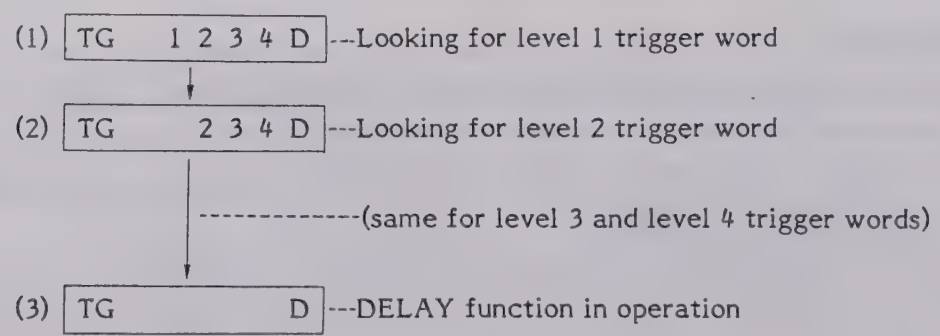


Fig. 5-34 Specifying Trigger Words

Trigger detection progress display

Pressing the RUN/STOP key starts the acquisition and adds the trigger detection progress display (see Fig. 5-35(1)) to the bottom of the screen. This real time display keeps the user advised of how the trigger function is proceeding.


(1) TG 1 2 3 4 D ---Looking for level 1 trigger word
(2) TG 2 3 4 D ---Looking for level 2 trigger word
----------(same for level 3 and level 4 trigger words)
(3) TG D ---DELAY function in operation

NOTES

The screen shows the trigger detection progress for the MAIN mode together with that for the HIGH mode, but does not display the data until the trigger detection for both modes have finished.

Pressing the RUN/STOP key a second time halts the acquisition and brings the stored data by this time to the screen.

The data matching the level 4 trigger word is marked on the display ; the STATE and TIMING displays use a "T" (see Fig. 5-36), while the MAP displays use an "X".

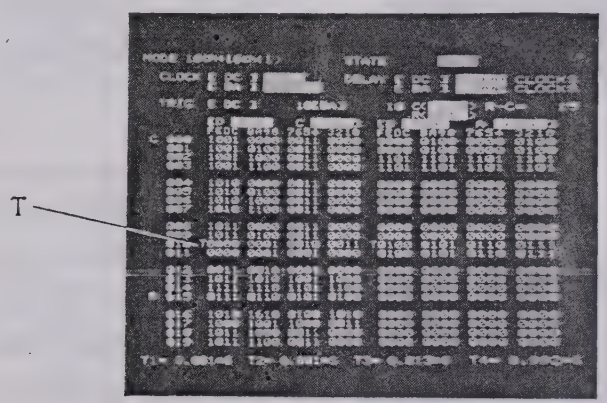


Fig. 5-36 T-Mark on a STATE Display

When the sequential trigger function is not required, specify the trigger word as the level 4 trigger word, and the position of the trigger word on the data screen can be indicated by T-mark as shown in Fig. 5-37.

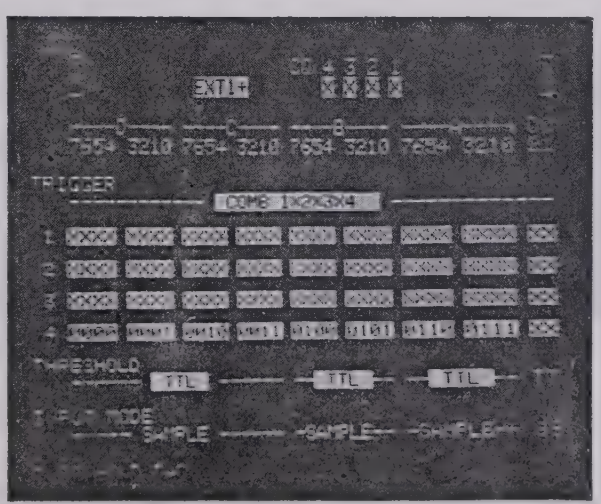
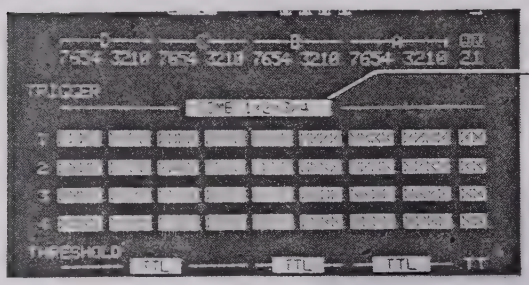
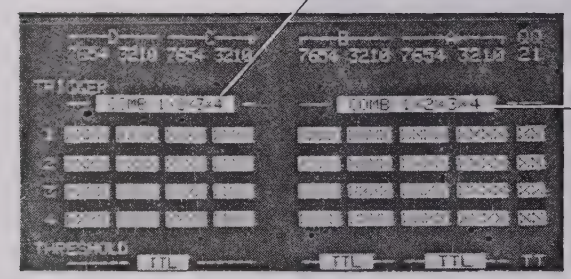


Fig. 5-37 Non-Sequential Trigger

The MAIN mode trigger options available vary with the trace mode. (see Fig. 5-38)

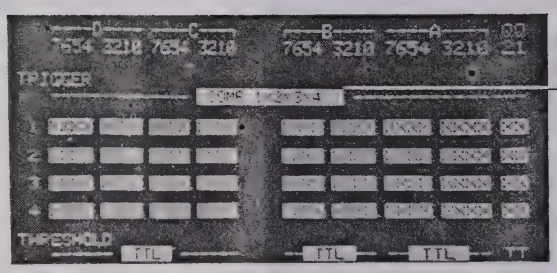


COMB 1 x 2 x 3 x 4 5-29
COMB 1 · 2 · 3 · 4 5-31
TRACE 1 x 2 x 3 x 4 5-32
TRACE 1 · 2 · 3 · 4 5-35
BUS 1 x 2 x 3 x 4 5-38
BUS 1 · 2 · 3 · 4 5-39
HIGH TRIG 5-35
NOT USED 5-41



COMB 1 x 2 x 3 x 4 5-29
COMB 1 · 2 · 3 · 4 5-31
BA TRIG* 5-37
HIGH TRIG 5-35
NOT USED 5-41

COMB 1 x 2 x 3 x 4 5-29
GLITCH 5-39
DC TRIG** 5-37
HIGH TRIG 5-35



COMB 1 x 2 x 3 x 4 5-29
COMB 1 · 2 · 3 · 4 5-31
TRACE 1 x 2 x 3 x 4 5-32
TRACE 1 · 2 · 3 · 4 5-35
HIGH TRIG 5-35
NOT USED 5-41

Fig. 5-38 Trigger Options

* Not available when Probes B and A use DC TRIG.

* * Not available when Probes D and C use BA TRIG.

(a) COMB 1 x 2 x 3 x 4

Operation

This option tells the trigger function to search the incoming data for each of the four trigger words sequentially.

32ch trace mode

The trigger function searches the data on 34 channels : The 32 channels from Probes D through A and the two data qualifier channels DQ2 and DQ1 from Probe E. Note that the data from data qualifiers are not stored.

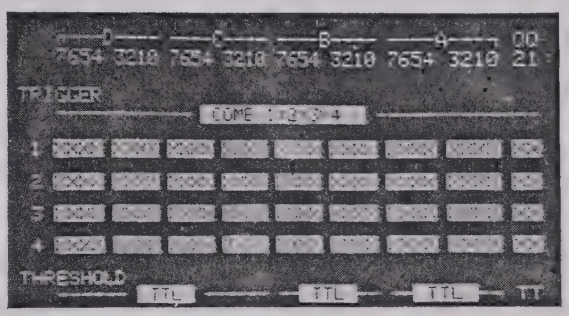


Fig. 5-39 32ch mode

16ch(1) trace mode

The trigger function searches the synchronous data from Probes D and C and the asynchronous data from Probes B and A independently. In the former case, it searches only the 16 channels of data from the Probes D and C; in the latter, it searches 18: the 16 channels of data from Probes B and A and the two data qualifier channels DQ2 and DQ1 from Probe E. Note that the data from the data qualifiers are not stored.

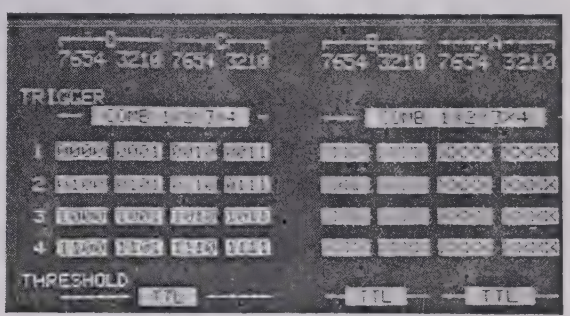


Fig. 5-40 16ch (1) mode

16ch(2) trace mode

The trigger function searches the data on 34 channels : the 32 channels from Probes D through A and the two data qualifier channels DQ2 and DQ1 from Probe E.

When the Probes D and C use a different clock from Probes B and A, it first searches the 16 channels of data from the Probes D and C. Then, when it finds a match, it searches remaining 18 channels only during the matching period.

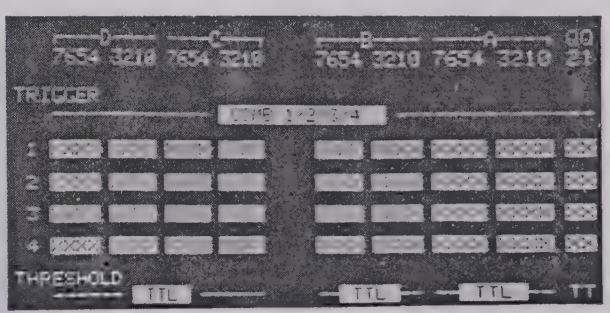


Fig. 5-41 16ch (2) mode

Note that the data from the data qualifiers are not stored.

D 1	0 0 0 0 H
D 2	0 0 0 0 H
D 3	4 5 6 7 H
D 4	0 0 0 0 H
D 5	0 1 2 3 H
D 6	0 0 0 0 H
D 7	4 5 6 7 H
D 8	0 0 0 0 H
D 9	0 0 0 0 H
D10	8 9 A B H
D11	0 0 0 0 H
D12	0 0 0 0 H
D13	0 0 0 0 H
D14	C D E F H
D15	0 0 0 0 H
D16	0 0 0 0 H
D17	0 0 0 0 H

Example of trigger search

For our example, we shall limit ourselves to 16 channels of synchronous data from the 16ch(1) trace mode and use the trigger specifications appearing in Fig. 5-40. The first match for level 1 trigger word, 0123H (where H stands for hexadecimal), occurs at data item D5. Data item D3 matches the trigger word for level 2, but is ignored because it precedes the match for level 1. The instrument goes on to find the matches for the next three levels as data items D7, D10 and D14.

Sample application

The sample program flow is shown in Fig. 5-42. The execution process of the subroutine SUB 1 after block C of the main program may differ from that when the subroutine is called by blocks A and B. We are interested in the third execution, the one following the execution of block C, but it cannot be selectively captured by simply specifying the address of the entry point for SUB 1 as the trigger word. There is no such difficulty if we specify our trigger words as the starting addresses of blocks A (level 1), B (level 2) and C (level 3) followed by the address of the entry point for SUB 1 (level 4). (see Fig. 5-43)

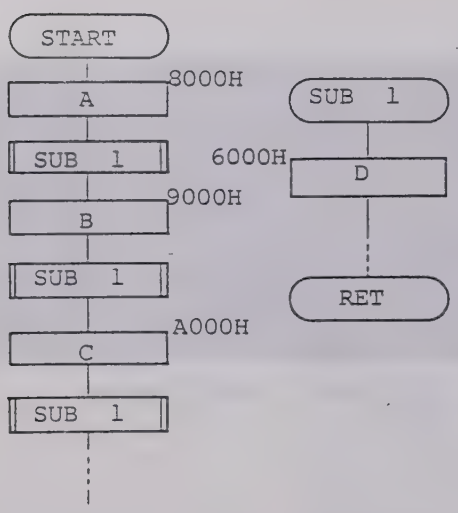


Fig. 5-42 Program

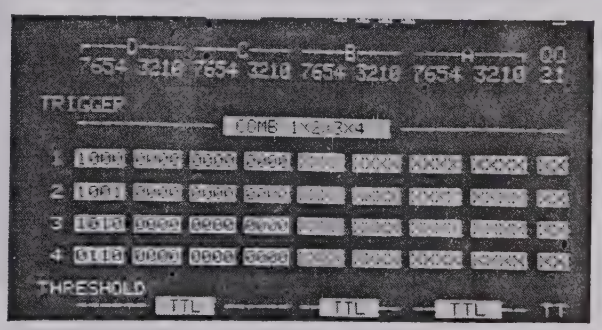


Fig. 5-43 Sample application for COMB 1x2x3x4

(b) COMB 1・2・3・4

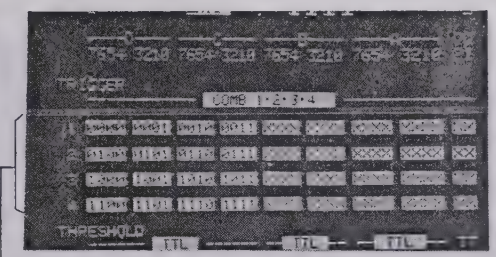
Operation

This option tells the trigger function to search the incoming data for the sequence made up of the four trigger words with no intervening data.

This option is not available for the asynchronous half (Probes B and A) of the 16ch(1) trace mode.

Example of trigger search

Our example uses the 16 channels of synchonous data from the 16ch(1) trace mode with the trigger specifications appearing in Fig. 5-44. The first successful match occurs for data items D13-15. Data items D4-6 constitute a pratical match ; only the first three trigger words match.



D 1	0 0 0 0 H
D 2	0 0 0 0 H
D 3	0 0 0 0 H
D 4	0 1 2 3 H
D 5	4 5 6 7 H
D 6	8 9 A B H
D 7	0 0 0 0 H
D 8	C D E F H
D 9	0 0 0 0 H
D10	0 0 0 0 H
D11	0 0 0 0 H
D12	0 0 0 0 H
D13	0 1 2 3 H
D14	4 5 6 7 H
D15	8 9 A B H
D16	C D E F H
D17	0 0 0 0 H

Fig. 5-44 Sample Application for COMB 1・2・3・4

(c) TRACE 1 x 2 x 3 x 4

Operation

This option tells the trigger function to first find, in sequential order, data matching the first three trigger words and then record only data items matching the fourth. The contents of the DELAY input field tells the function how many such data items to record.

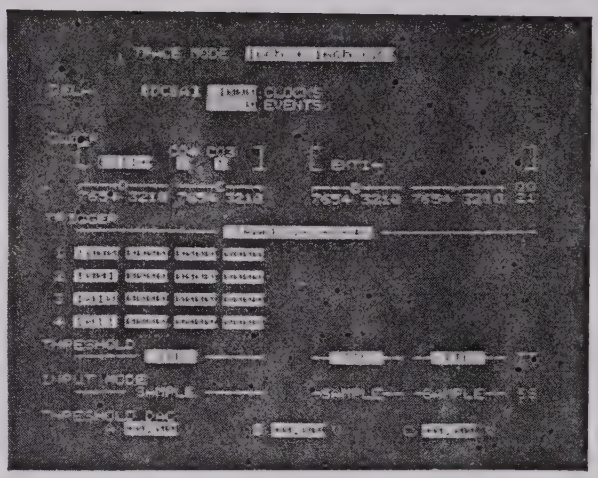


Fig. 5-45 Trace 1 x 2 x 3 x 4

32ch trace mode

For the 32ch trace mode, this option operates over all 48 MAIN mode and HIGH mode channels. The funcion detects the data items matching the first-three trigger words and then, when it reaches the fourth level, records each MAIN mode data item matching the fourth trigger word and the HIGH mode data received at that moment. At the end of execution, the display contains only the MAIN mode data matching the fourth trigger word together with the HIGH mode data received at that moment. Figures 5-46 and 5-47 show the two menus for these two trace modes.

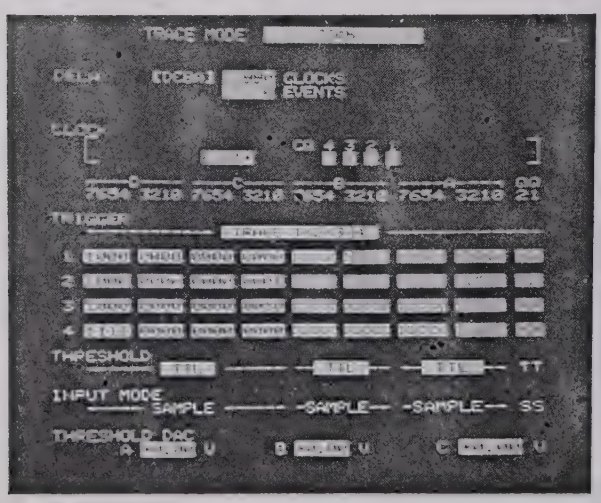


Fig. 5-46 Trace 1 x 2 x 3 x 4
(32ch Trace Mode MAIN mode)

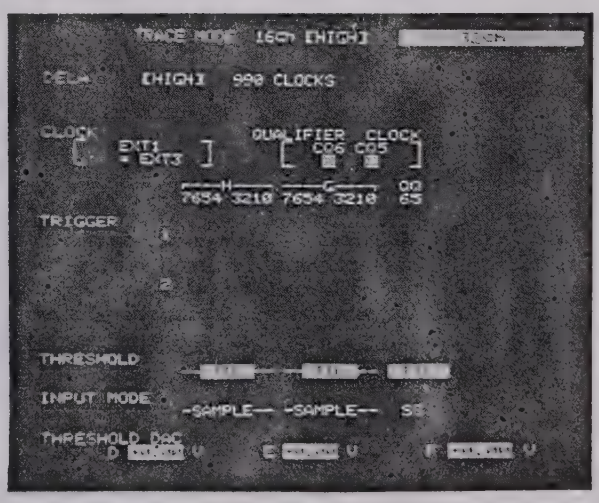


Fig. 5-47 Trace 1 x 2 x 3 x 4
(32ch Trace Mode HIGH mode)

NOTE

The external sampling clock circuits for the MAIN and HIGH modes are independent each other. Therefore, when using this option, sweeply the same clock signal to both EXT CK3 on Probe I and EXT CK 1 on Probe E.

16ch(2) trace mode

This option with the 16ch(2) trace mode tells the trigger function to search the data coming in from Probes D and C until it has found, in order, data items matching the first-three trigger words and then start recording the data from Probes D through A whenever it finds a match for the fourth one. In this trace mode, an external clock for Probes D and C is automatically supplied for Probes B and A.

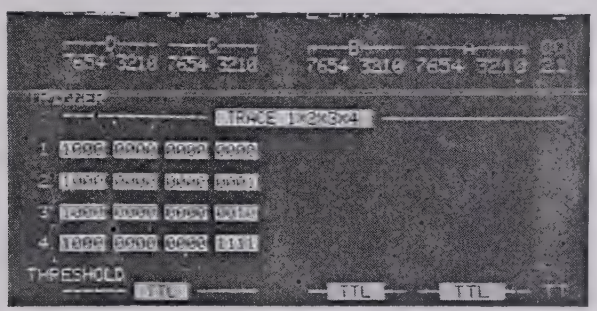


Fig. 5-48 TRACE 1 x 2 x 3 x 4 (16ch(2) Trace Mode)

Example of trigger search

Our example uses the 32ch trace mode with the MAIN and HIGH mode trigger specifications appearing in Figures 5-49 and 5-50 and the incoming data shown in Table 5-5. Detected first-three data items are D2 -D4 and recorded are data items D8, D9, D10, D3 and D15, matching the fourth trigger word.

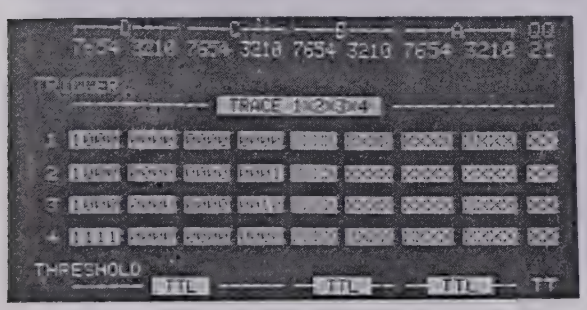


Fig. 5-49 MAIN mode

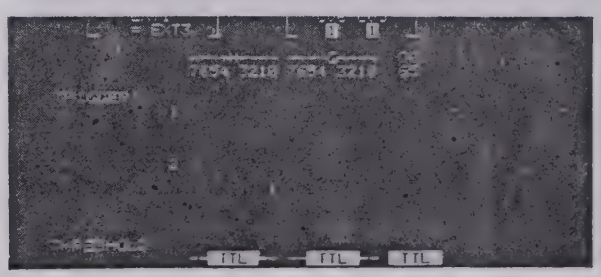


Fig. 5-50 HIGH mode

	D	C	B	A	H	G
D 1	00	00	00	00	00	01
D 2	80	00	00	00	00	02
D 3	80	00	10	00	00	03
D 4	80	00	20	00	00	04
D 5	80	00	30	00	00	05
D 6	80	00	40	00	00	06
D 7	80	00	50	00	00	07
D 8	F0	00	00	00	00	08
D 9	F0	00	10	00	00	09
D10	F0	00	20	00	00	0A
D11	90	00	00	00	00	0B
D12	90	00	10	00	00	0C
D13	F0	00	30	00	00	0D
D14	90	00	20	00	00	0E
D15	F0	00	40	00	00	0F

Table 5-5

See Sample Application below.

Sample Application

The programs for microprocessor applications can sometimes grow quite large. Debugging such programs can involve either tracing the execution of one particular segment--as we did in our sample application for the COMB trigger specification--or examining the affects of program execution on the contents of a particular memory location. The TRACE trigger function is designed for applications like these. Storing only the addresses and their contents of interest makes it easy to analyze even the largest program within the limited memory capacity available.

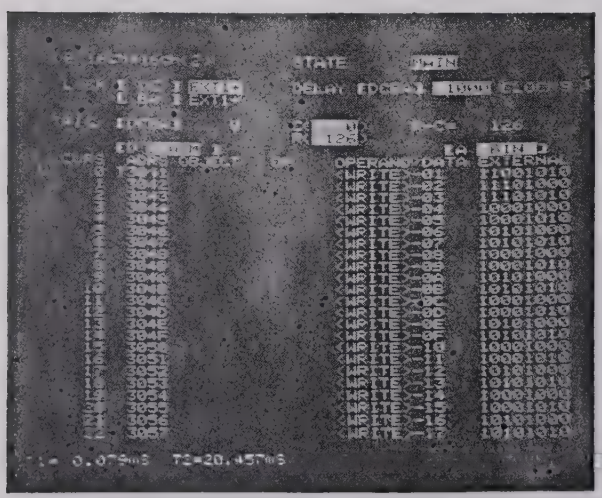


Fig. 5-51 Sample application for TRACE 1 x 2 x 3 x 4

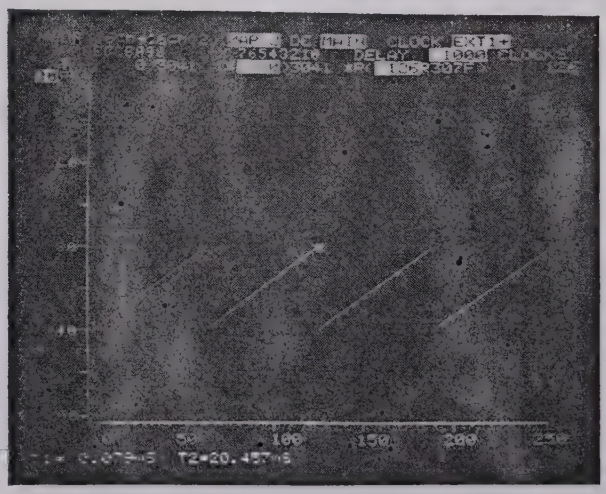


Fig. 5-52 Sample application for TRACE 1 x 2 x 3 x 4

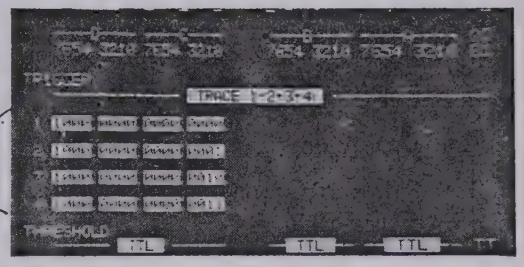
(d) TRACE 1 • 2 • 3 • 4

Operation

This option tells the function to monitor he incoming data for a sequence matching the four trigger words in a row, with no intervening data, and then start recording all data items matching fourth trigger word. After that, it operates the same as TRACE 1 x 2 x 3 x 4.

Example of trigger search

Our example uses the 16ch(1) trace mode with the trigger specification appearing in Fig. 5-53 and the incoming data shown in Table 5-6. Recorded are data items D13, 15 and 16.



	D	C	B	A
D 1	6 0	0 1		
D 2	6 0	0 2		
D 3	8 0	0 9		
D 4	8 0	0 A		
D 5	8 0	0 B		
D 6	8 0	0 C		
D 7	8 0	0 D		
D 8	8 0	0 E		
D 9	8 0	0 F		
D10	8 0	0 0		
D11	8 0	0 1		
D12	8 0	0 2		
D13	8 0	0 3		
D14	8 0	0 4		
D15	8 0	0 3		
D16	8 0	0 3		

Fig. 5-53 Sample application for TRACE 1 • 2 • 3 • 4

(e) HIGH TRIG

Operation

The HIGH TRIG option tells the trigger function to terminate the MAIN mode trigger search once it has detected the trigger word(s) for the HIGH mode and to start recording data. This means that the user can specify trigger words for the HIGH mode, but not for the probes for which the HIGH TRIG option has been specified. Once the trigger conditions have been satisfied, both the MAIN and HIGH modes record the number of data items specified by their particular DELAY input fields and then terminate.

The HIGH TRIG option is selected only on the MAIN mode menus.

Example of trigger search

Figures 5-54 and 5-55 show the trigger settings for the MAIN mode 16ch(1) trace mode and the HIGH mode, respectively.

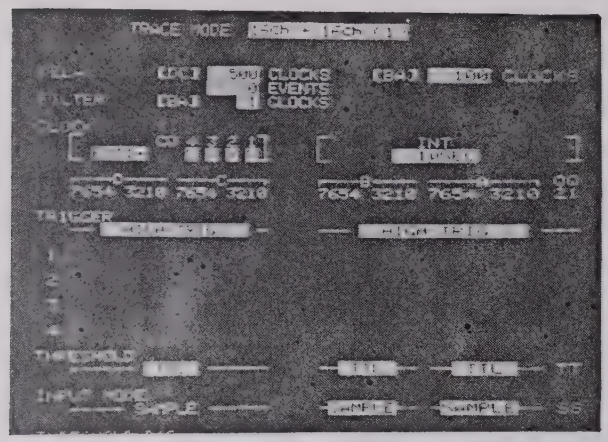


Fig. 5-54 HIGH TRIG Option

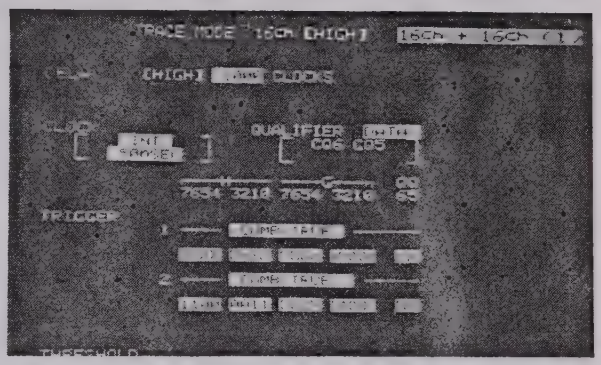


Fig. 5-55 HIGH Mode Trigger Words

The HIGH mode settings tell the instrument to search for the HIGH mode level 1 and level 2 trigger words. When it finds the level 2 word after detecting level 1, it immediately begins to acquire the HIGH mode data with the internal 50 ns clock. It stops after recording 1001 words.

The start of HIGH mode acquisition also initiates the MAIN mode data acquisition for the two 16-channel groups at exactly the same point. The only difference is that each group has its own clock and count : EXT CK 1 and 500 words for Probes D and C vs. internal 1 μs and 100 words for Probes B and A.

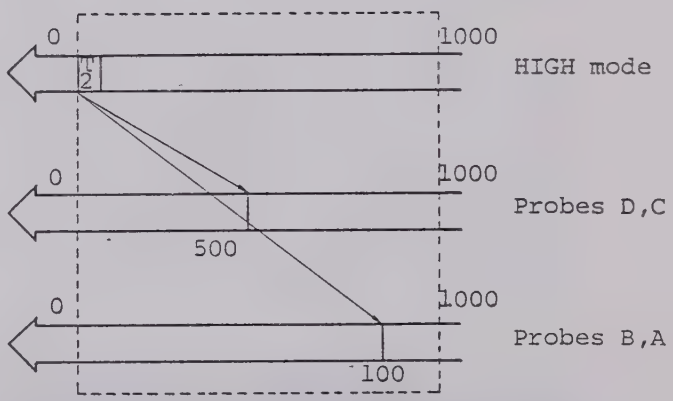


Fig. 5-56 Operation of HIGH TRIG

Sample application

The HIGH TRIG option is designed for those applications where it is necessary to establish the relationship between hardware and software. For example, when a hardware glitch causes a program to run out of control, we use the MAIN mode probes for the software and the HIGH mode ones for the hardware. Then, if we use glitches as the trigger for stopping the trace, we can analyze the source of the glitch and its effects on the surrounding circuits with the HIGH mode and, since the HIGH TRIG option stops the MAIN trace as well, then determine the effect this glitch has on the software.

(f) BA TRIG

Operation

This option, available only for the 16ch(1) trace mode, links the triggers for Probes D and C to the ones for Probes B and A. Thus, when all four trigger levels have been satisfied for Probes B and A, and acquisition for Probes D, C, B and A stop at the same moment. Needless to say, no trigger words can be separately specified for such probes D and C.

NOTE

BA TRIG cannot be used when Probes B and A use the DC TRIG option.

Fig. 5-57 BA TRIG

Sample application

The BA TRIG option is available for the 16ch(1) trace mode, a mode which provides timing diagram displays. It thus lends itself to applications requiring multi-channel analysis of hardware data as well as analysis of the effects of hardware operations on software.

(g) DC TRIG

Operation

This option, available only for the 16ch(1) trace mode, links the triggers for Probes B and A to the ones for Probes D and C. Thus, when all four trigger levels have been satisfied for Probes D and C, the acquisition for Probes D, C, B and A stop at the same moment. Needles to say, no trigger words can be separately specified for probes B and A.

NOTE

DC TRIG cannot be used when Probes D and C use the BA TRIG option.

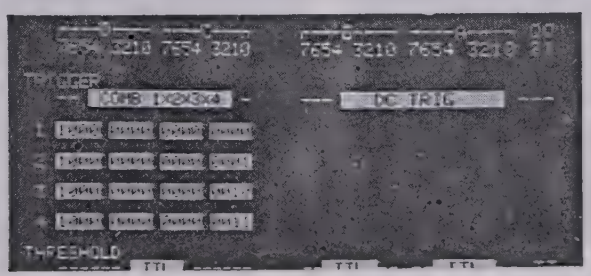


Fig. 5-58 DC TRIG

(h) BUS 1 x 2 x 3 x 4

Operation

This option is only available for the 32ch trace mode. This option searches for trigger words defined over a total of 52 channels of data : 34 for the MAIN mode and 18 for the HIGH mode.

The searches first proceed independently. (see Fig. 5-59) Then, when the function has found the first three trigger words for the MAIN mode and the first one for the HIGH mode, it puts the two modes together to form the bus trigger with trigger words of level 4 in the MAIN mode and level 2 in the HIGH mode.

The search for trigger words at levels 1 through 3 proceeds exactly the same as with the COMB 1 x 2 x 3 x 4 ; the function searches for data items matching the trigger words sequentially.

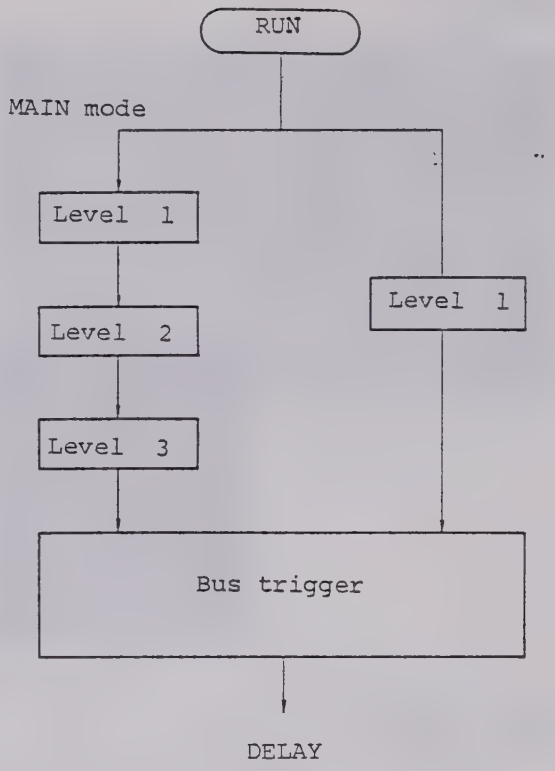


Fig. 5-59 BUS 1 x 2 x 3 x 4

NOTE

When using this option, supply the same external clock signals to both the MAIN mode (CK1 on Probe E) and the HIGH mode (CK3 on Probe I).

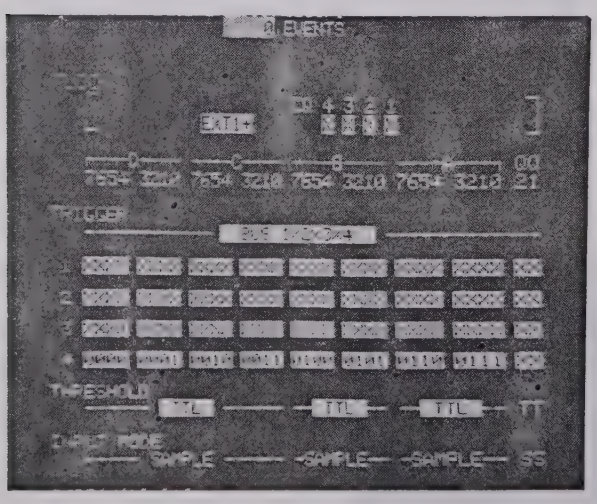


Fig. 5-60 BUS 1 x 2 x 3 x 4
Selection on MAIN Mode Menu

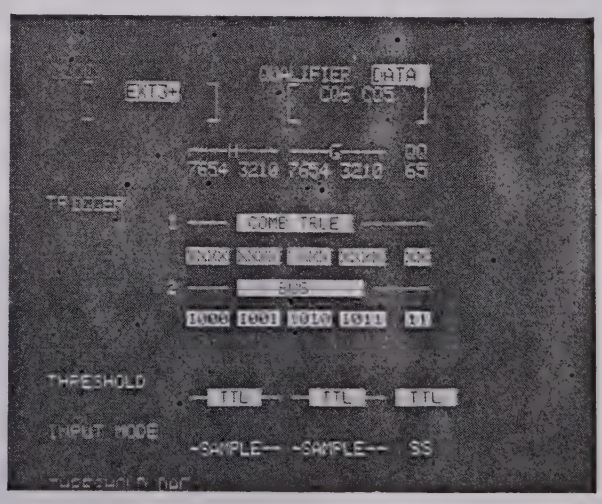


Fig. 5-61 BUS 1 x 2 x 3 x 4
Selection on HIGH Mode Menu

Sample application

This option searches a total of 52 channels for the trigger data, so lends itself to simultaneous, multi-channel analysis. The 32 channels available for other options are sometimes insufficient for proper analysis of 16-bit microprocessor operation. Having 52 channels available makes it possible to simultaneously monitor both the 16 channels of the data bus and the 16-24 channels of the address bus and then specify the trigger words in terms of particular combinations of both data and addresses.

(i) BUS 1 · 2 · 3 · 4

Operation

This option represents a special case of the BUS 1 x 2 x 3 x 4 option ; the four MAIN trigger words must occur consecutively, without any intervening data items, after the function has found a HIGH mode data item matching the HIGH mode level 1 trigger word. (see Fig. 5-62)

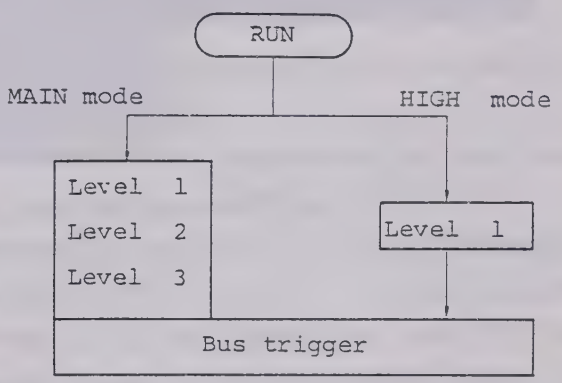


Fig. 5-62 BUS 1 · 2 · 3 ·

NOTE

When using this option, supply the same external clock signals to both the MAIN mode (CK1 on Probe E) and the HIGH mode (CK3 on Probe I).

(j) GLITCH

Operation

This option tells the trigger function to search for glitches in the incoming data stream start recording data when it detects one. It is available for the HIGH mode data and the MAIN 16ch(1) trace mode data from Probes B and A, but the operation differs slightly between the two.

MAIN mode

The GLITCH trigger option allows the user to specify glitch triggers separately for each channel. This means, the user can tell the instrument to ignore glitches for some channels and concentrate on others. The trigger then operates when the instrument detects the first glitch on any of the channels for which a trigger has been specified.

The example in Fig. 5-63 tells the instrument to check for glitches on channel 4 on Probe B and channel 2 on Probe A and start recording data when it detects a glitch on either one. Note that the contents of the input field tell the function to ignore any glitches that may appear on any of the other channels.

The minimum pulse duration that the function can detect is 10 ns. At the same time the glitch must have a minimum amplitude of 0.8 V. (see Fig. 5-64)

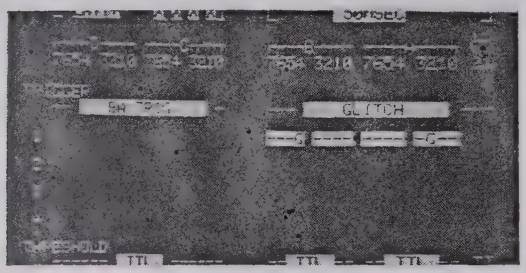


Fig. 5-63 GLITCH Trigger (MAIN Mode)

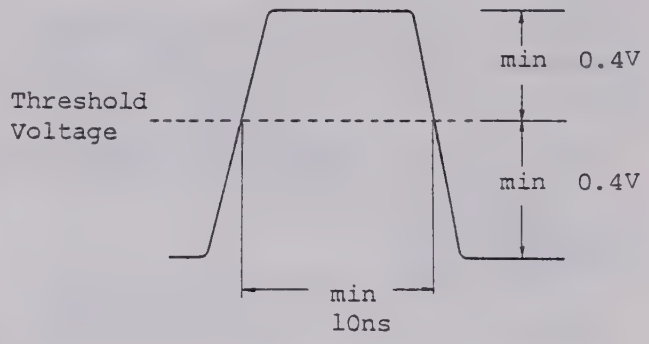


Fig. 5-64 Glitch-Detecting Ability

Specifying the glitch trigger

The GLITCH specifications shown in Fig. 5-63 are set just like any other input field : use the EDIT keys (17)-(20) to activate the blink and shift it to the TRIGGER input field for Probes B and A (1 in Fig. 5-63). Then use the EDIT S key to switch the contents to GLITCH. Next, use the EDIT key (18) to shift the blink to the trigger word input field (2 in Fig. 5-63). Shift the blink to Probe B channel 4 by hitting the "0" key (8) three times. Specify a glitch trigger for channel 4 by hitting the "1" key (7). Shift the blink to Probe A channel 2 with the "0" key (8). Specify a glitch trigger by hitting the "1" key (7).

Sample application

One of the most frequent causes of misoperation in digital circuits is glitches. Yet pinning down the causes of these misoperations involves a great deal of time for two reasons : first, because the user never knows when or where a glitch will occur and, secondly, because the after-effects of glitches are not always the same.

The VP-3662A Logic Analyzer's glitch and linking trigger functions facilitate the analysis of the effects on hardware operations and the effects on the software.

Note : By linking trigger, we refer to such trigger functions as BA TRIG, DC TRIG, DCBA TRIG, and HIHG TRIG.

We first connect the HIGH mode probes--or alternatively, MAIN mode Probes B and A in the 16ch(1) trace mode--to the lines suspected of having glitches and other closely related lines. Then we connect the synchronous 16ch(1) trace mode probes to the bus or other lines that require synchronous tracing.

If we use the glitch as the trigger signal, we can display the glitch and its effects on the hardeware as a timing diagram. In addition, using the BA TRIG or HIGH TRIG option for the sychronous half of the 16ch(1) trace mode gives us data which shows the effect the glitch has on the software.

NOTE

Always set the INPUT MODE input field to LATCH whenever using the GLITCH trigger. The SAMPLE mode cannot capture glitches with any certainty.

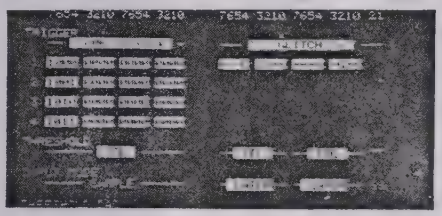


Fig. 5-65 Input Mode Selection for the Glitch Trigger

(k) NOT USED

This option, available for the 32ch trace mode, the MAIN mode portion of the 16ch(2) trace mode, and probes D and C of the 16ch(1) trace mode, permits the user to display stored data even though the synchronous part of the instrument does not acquire any input data.

Always specify this option when not using a trigger for the synchronous part. Otherwise, the instrument will hang up, using an external clock that will never arrive and waiting for a trigger that will never come, and thus never display the data it has stored for the asynchronous part(s).

Fig. 5-66 shows an example of this option used for Probes D and C in the 16ch(1) trace mode.

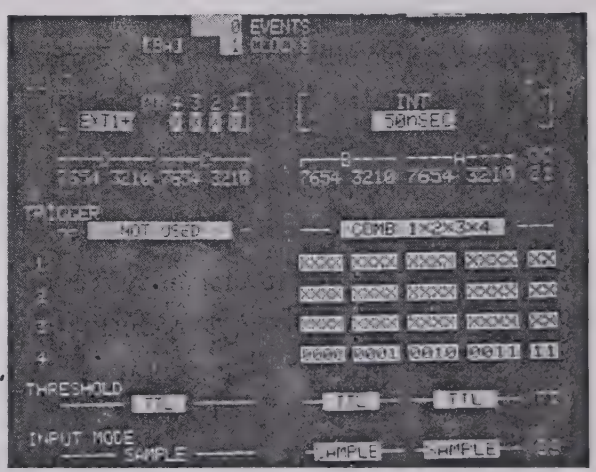


Fig. 5-66 NOT USED Display (Sample)

(2) HIGH Mode Sequential Trigger

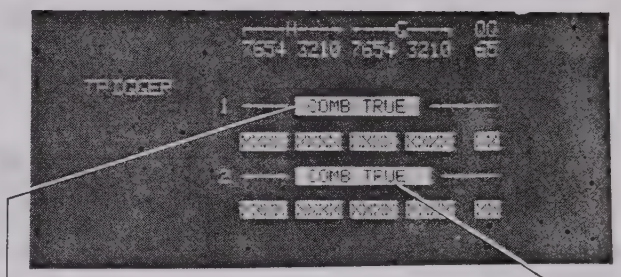
The HIGH mode has a 2-level sequential trigger. The stored data does not appear on the screen until the trigger function has found data items matching both trigger words. Unlike the MAIN mode, the trigger options for the HIGH mode can be set independently for each trigger word. (see Fig. 5-67) The two modes use, however, the same procedures for selecting among the various options (even though the options themselves differ) and for specifying the trigger words.

The instrument puts a capital "T" to left of the data item matching the level 2 trigger word so, when using only one trigger word, always make it level 2.

NOTES

Always set HIGH mode trigger options after setting those for the MAIN mode; the selection of certain MAIN options automatically limits the options available in the HIGH mode. Setting in the opposite order may result in invalid combinations.

The stored data does not appear on the screen until all tracing functions for both modes have finished execution. To view the data stored thus far, terminate the acquisition by pressing the RUN/STOP key.



	Page
COMB TRUE	5-43
DCBA TRIG	5-47
DC TRIG	5-44
BA TRIG	5-46
EXT1 +	5-48
EXT1 -	5-48

	Page
COMB TRUE	5-43
COMB FALSE	5-43
BUS	5-47
GLITCH	5-47
DCBA TRIG	5-47
DC TRIG	5-44
BA TRIG	5-46
EXT2 +	5-48
EXT2 -	5-48

Fig. 5-67 HIGH Mode Trigger Options

(a) COMB TRUE

Operation

This option, available at both levels, defines the trigger as occurring when the logical result of a bit-by-bit comparison of the incoming data with the trigger word is TRUE. Thus the settings shown in Fig. 5-68 result in triggers placed as shown in Fig. 5-69.

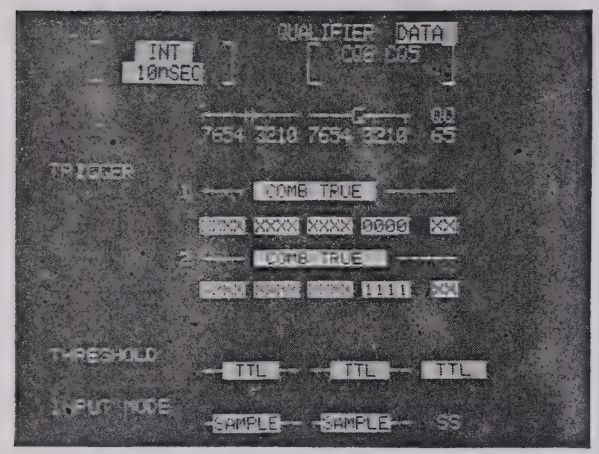


Fig. 5-68 COMB TRUE Settings (Sample)

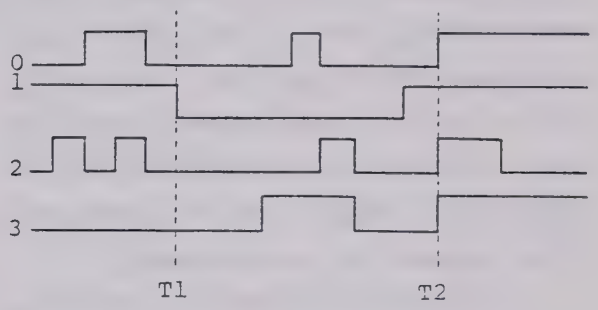


Fig. 5-69 COMB TRUE (Acquired Data)

(b) COMB FALSE

Operation

This option, available only at level 2, defines the trigger as occurring when the logical result of a bit-by-bit comparisons of the incoming data items with the trigger word changes from TRUE to FALSE. (see Figures 5-70 and 5-71)

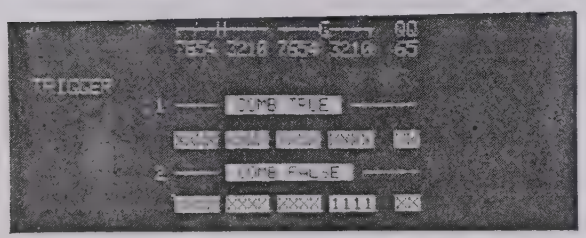


Fig. 5-70 COMB FALSE Setting (Sample)

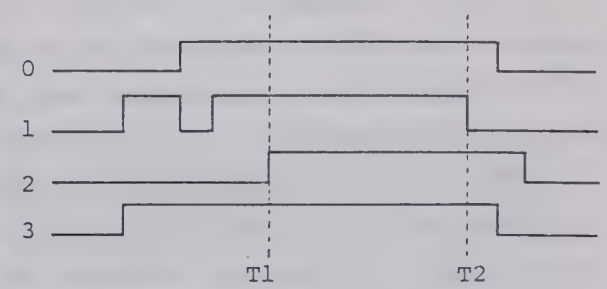


Fig. 5-71 COMB FALSE (Acquired Data)

Note that there are two trigger points marked on Fig. 5-70. The first, t_1, is the trigger point for a COMB TRUE specification ; the second, for the COMB FALSE specification.

Sample application

Let us demonstrate when an option like COMB FASLE might be needed. Suppose that a certain, fixed data pattern continues for a long period, only to be interrupted by a operation fault. Suppose further that the user is interested in looking at what happens after the fault with a high-speed sampling clock. The COMB TRUE option places the trigger point at t_1 in Fig. 5-71 so the user would have to specify a rather long delay. for some clocks, the required delay might even be beyond the memory capacity of the instrument.

The COMB FALSE option removes this difficulty by telling the instrument to start the delay counter when fixed pattern ends (the comparison yields FALSE), rather than when it startrs. The user can then use a small delay number and still be sure of acquiring the data the needs.

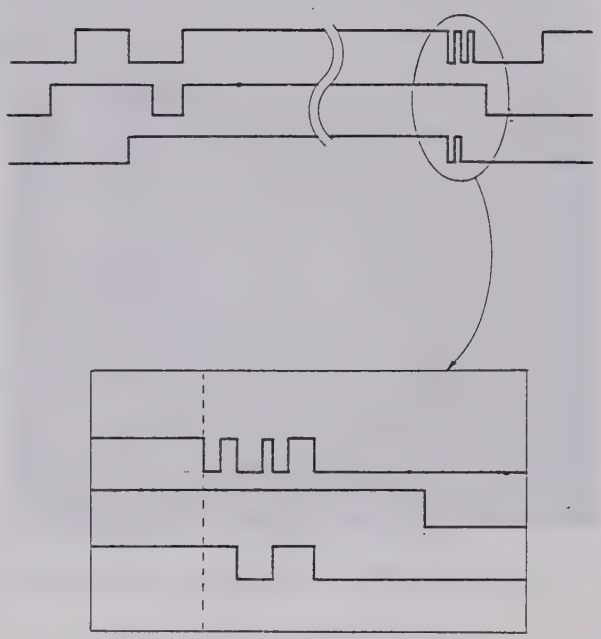


Fig. 5-72 Application of COMB FALSE Option

(c) DC TRIG

Operation

This option, available only in the 16ch(1) trace mode, "links" the triggering of HIGH mode probes to that of the probes D and C in the MAIN mode. When it is set for trigger level 1, the HIGH mode trigger function first waits for trigger detection of Probes D and C in the MAIN mode and then searches the HIGH mode data for its level 2 word. (see Fig. 5-73)

When it is set for trigger level 2, trigger detection for MAIN mode Probes D and C after detection of HIGH mode level 1 stops the acquisition as shown in Fg. 5-74.

NOTES

(1) DC TRIG cannot be specified when the MAIN mode trigger function for Probes D and C is set to HIGH TRIG or NOT USED.

(2) DC TRIG cannot be specified for both HIGH mode trigger levels at the same time. If only a link to Probes D and C is required, use the DC TRIG option for level 2 and COMB TRUE, with a trigger word filled with X's ("Don't Care"), for level 1.

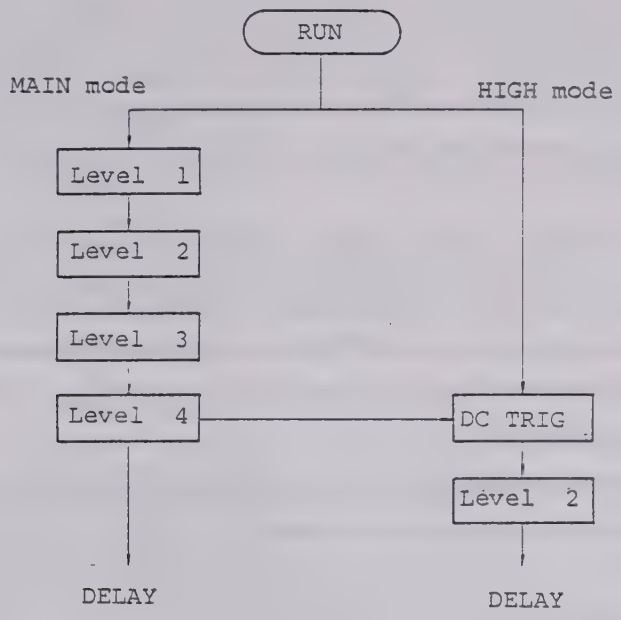


Fig. 5-73 DC TRIG at HIGH Mode Level 1

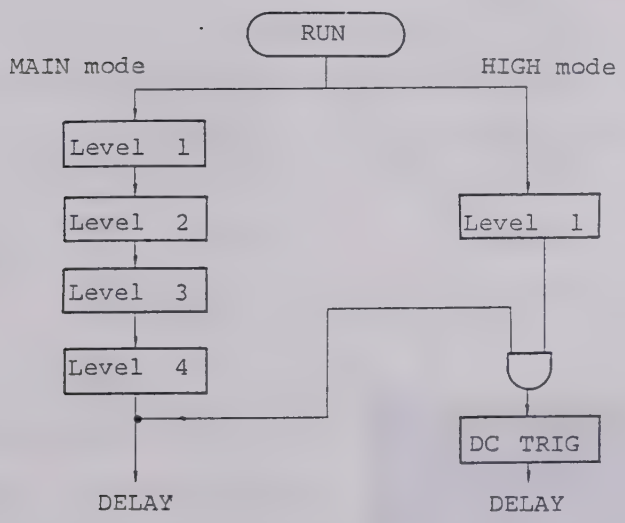


Fig. 5-74 DC TRIG at HIGH Mode Level 2

Applications

The DC TRIG option is designed for analyzing the interaction between hardware and software. When the software (Probes D and C) has reached a certain state, the trigger function starts the high-speed sampling for the related hardware (HIGH mode probes).

(d) BA TRIG

Operation

This option, available only in the 16ch(1) trace mode, "links" the triggering of HIGH mode probes to that of the probes B and A in the MAIN mode. When it is set for trigger level 1, the HIGH mode trigger function first waits for trigger detection of Probes B and A in the MAIN mode and then searches the HIGH mode data for its level 2 word.
(see Fig. 5-75)

When it is iset for trigger level 2, trigger detection for MAIN mode Probes B and A after detection of HIGH mode level 1 stops the acquisition as shown in Fig. 5-76.

NOTES

(1) BA TRIG cannot be specified when the MAIN mode trigger function for Probes B and A is set to HIGH TRIG.

(2) BA TRIG cannot be specified for both HIGH trigger levels at the same time.

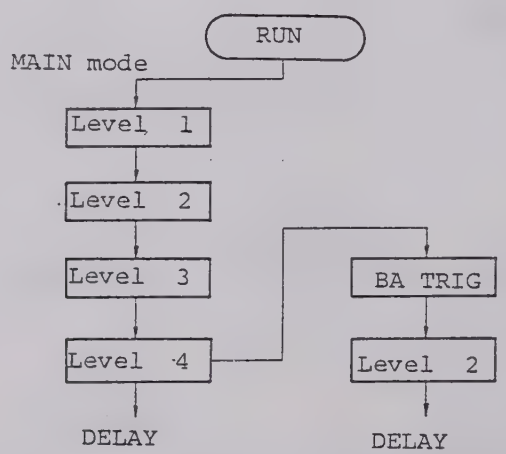


Fig. 5-75 BA TRIG at HIGH Mode Level 1

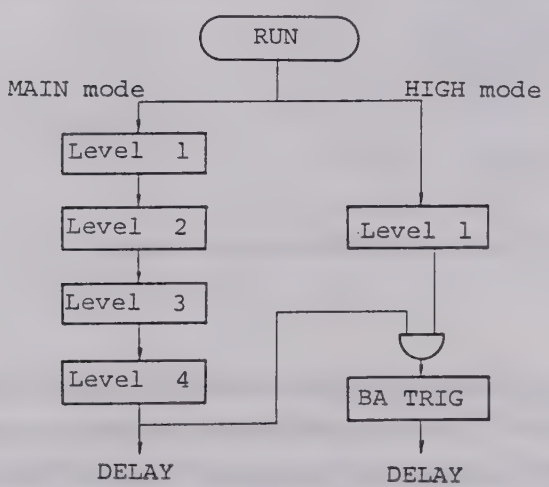


Fig. 5-76 BA TRIG at HIGH Mode level 2

(e) DCBA TRIG

This option, available only in the 32ch trace mode, "links" the triggering of HIGH mode probes to that of the MAIN mode probes. When it is set for trigger level 1, the HIGH mode trigger function first waits for the MAIN mode trigger function to finish and then searches the HIGH mode data for its level 2 word.

When it is set for trigger level 2, the MAIN mode trigger detection after detection of HIGH mode level 1 stops the acquisition.

NOTE

DCBA TRIG cannot be specified for both HIGH trigger levels at the same time.

Applications

This option is designed for the analysis of the activity on an 8- or 16-bit microcomputer's address and data busses (using the 32 channels of the MAIN mode) together with high-speed tracing of hardware activity once the busses have reached a certain state. The MAIN mode trigger specifications define this state while the DCBA TRIG option tells the HIGH mode trigger function to start the tracing when the MAIN mode trigger detects this state.

(f) BUS

This option is the HIGH mode counterpart of the options BUS 1 x 2 x 3 x 4 and BUS 1 · 2 · 3 · 4 for the MAIN mode. The instrument automatically inserts it in the level 2 position whenever the user specifies one of the BUS options for the MAIN mode trigger. This option cannot be specified in the level 1 position. (for details, refer to sections (h) and (i) under the MAIN mode trigger functions)

(g) GLITCH

Operation

This option is a little different from that for the MAIN mode in that it does not allow the user to specify the channels to be monitored for glitches. The instrument monitors all 16 of the HIGH mode channels and generates the trigger signal on the first glitch detected on any one of them.

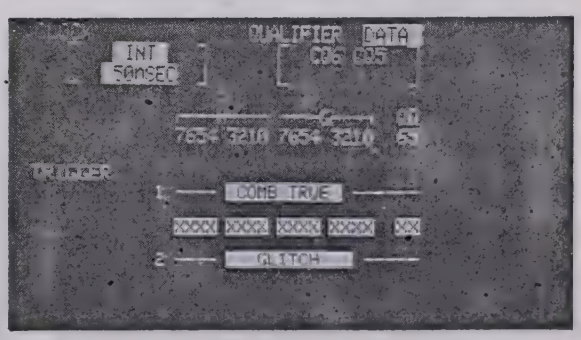


Fig. 5-77 GLITCH Trigger (HIGH mode)

The minimum pulse duration that the function can detect is 5 ns. At the same time the glitch must have a minimum amplitude of 0.8 V.
(see Fig. 5-78)

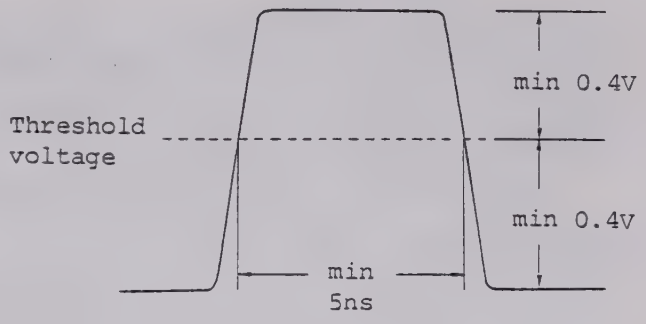


Fig. 5-78 Glitch-Detecting Ability

NOTE

Always set the INPUT MODE input field to LATCH whenever using the GLITCH trigger. The SAMPLE mode cannot capture glitches with any certainty.

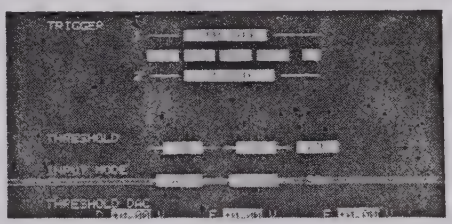


Fig. 5-79 Input Mode Selection for the Glitch Trigger

(h) EXT 1 + , EXT 1 -

The HIGH mode also accepts external trigger signals. Specifying EXT 1, the external trigger, for level 1 tells the instrument to stop scanning the incoming data and use the external trigger, ET1 on Probe I, instead. The sign specifies which edge of the trigger signal the instrument is to use : "+" for rising, "-" for falling.

(i) EXT 2 + , EXT 2 -

Similarly, specifying EXT 2, the external trigger, for level 2 tells the instrument to stop scanning the incoming data and use the external trigger, ET2 on Probe I, instead. The sign specifies which edge of the trigger signal the instrument is to use : "+" for rising, "-" for falling.

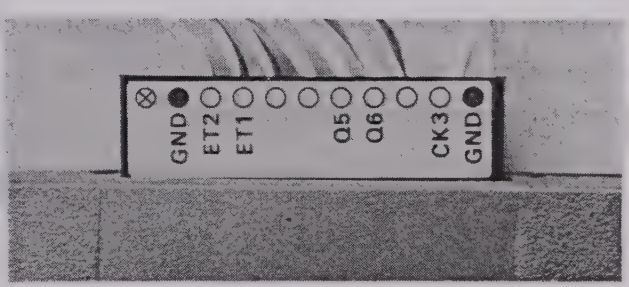


Fig. 5-80 External Trigger Inputs

5-6 QUALIFIERS

The VP-3662A Logic Analyzer provides two types of qualifiers : DATA and CLOCK qualifiers. Note, however, that the MAIN and HIGH modes uses them in different ways.

Data qualifier

Although this instrument features data recording on 32 channels for the MAIN mode and 16 for the HIGH mode, sometimes 48 channels of data is not enough to fully specify the data of interest. Therefore, the instrument provides additional control means for the trigger detecting functions. The input channel for this purpose are called the "data qualifier".

Clock qualifier

The acquisition of synchronous data involves sampling and recording the data for every rising (or falling) edge of the external clock signal. However, it is often more effecient to record the data for only a certain subset of these edges. Defining this subset is the "clock qualifier". The instrument records the data sampled using the external clock only when the clock qualifier meet the conditions which appear on the trace mode menu display. Our example (Fig. 6-81) has "1" for the clock qualifiers CQ1 and CQ2.

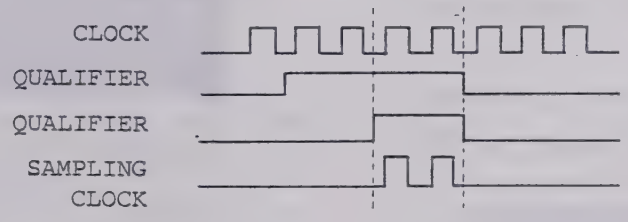


Fig. 5-81 Clock Qualifiers

(1) MAIN mode qualifiers

(a) Data qualifiers

The MAIN mode allows the user to add two data qualifier inputs whose interaction with the channels from the four probes varies with the trace mode :

i. 32ch trace mode

The trigger function for the 32ch trace mode adds the two data qualifier channels to the 32ch recorded data channels. The trigger words, therefore, are 34 bits long.

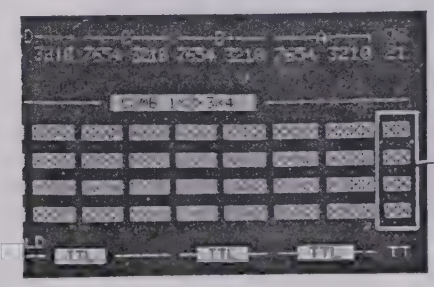


Fig. 5-82 Data Qualifiers (32ch Trace Mode)

ii. 16ch(1) trace mode

The trigger function for the 16ch(1) trace mode adds the two data qualifier channles to the 16 recorded data channels from Probes B and A. Therefore, while the trigger words for Probes D and C are only 16 bits long, those for Probes B and A are longer, at 18 bits each.

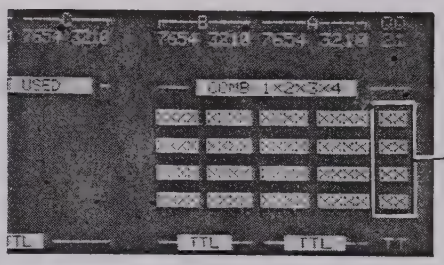


Fig. 5-83 Data Qualifiers
(16ch(1) Trace Mode)

iii. 16ch(2) trace mode

The trigger function for the 16ch(2) trace mode adds the two data qualifier channels to the two 16-channel groups of recorded data from Probes D through A. The trigger words, therefore, are 34 bits long.

NOTES

The threshold voltages for the data qualifiers are the same as that for Probe B.

When not using data qualifiers, set the trigger input fields to "X" ("Don't care").

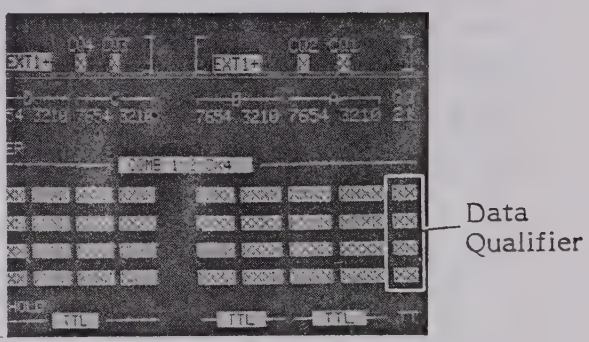


Fig. 5-84 Data Qualifiers
(16ch(2) Trace Mode)

(b) Clock qualifiers

The MAIN mode accepts up four clock qualifier inputs, whose interaction with the channels from the four probes varies with the trace mode :

i. 32ch and 16ch(1) trace modes

The four clock qualifiers all act as qsualifiers on the external clock EXT1.

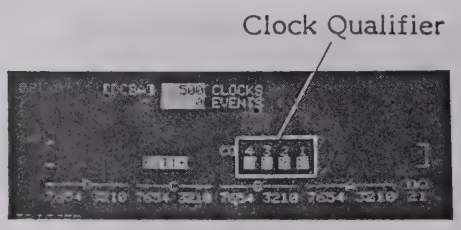


Fig. 5-85 Clock Qualifiers
(32ch Trace Mode)

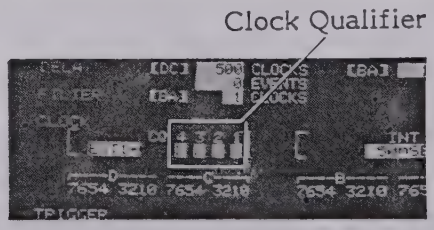


Fig. 5-86 Clock Qualifiers
(16ch(1) Trace Mode)

ii. 16ch(2) trace mode

The clock qualifiers CQ4 and CQ3 qualify the sampling clock for Probes D and C (EXT 1), while CQ2 and CQ1 qualify the sampling clock for Probes B and A (EXT 1 or EXT2).

NOTES

The threshold voltages for external clock EXT1 and the clock qualifiers CQ4 and CQ3 are all the same as that for Porbes D and C.

The threshold voltages for external clock EXT2 and the clock qualifiers CQ2 and CQ1 are all the same as that for the Probe B.

When not using clock qualifiers, set the trigger input fieles to "X" ("Don't care").

All MAIN mode qualifier inputs come from Probe E.

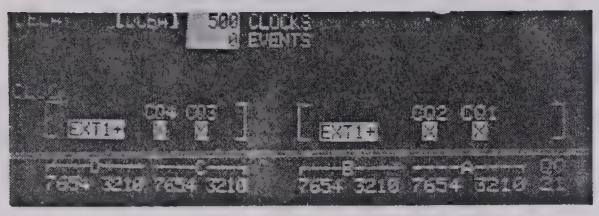


Fig. 5-87 Clock Qualifiers (16ch(2) Trace Mode)

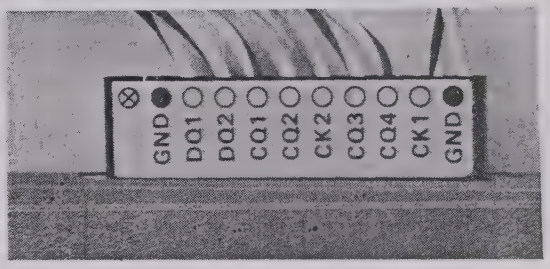


Fig. 5-88 Probe E Inputs

(2) HIGH mode qualifiers

The HIGH mode allows only two channels of qualifier input. The user must specify either DATA or CLOCK in the corresponding input field (see Fig. 5-89) ; the two types cannot be mixed. The two channels use the same input terminals, Q5 and Q6 on Probe I.

Fig. 5-89 Specifying Qualifier Type

(a) Data qualifiers

When the user specifies data qualifiers, the trigger function for the HIGH mode adds them to the 16 data channles and uses 18-bit trigger words.

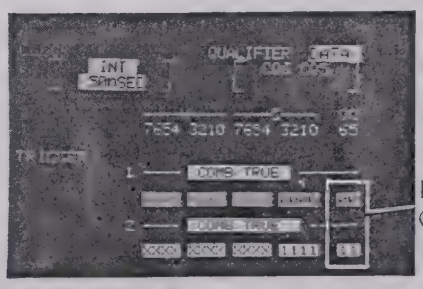


Fig. 5-90 HIGH Mode Data Qualifiers

(b) Clock qualifiers

When the user specifies clock qualifiers, the two inputs act as qualifiers on the external clock CK3.

The qualifier and external clock inputs come from Probe I.

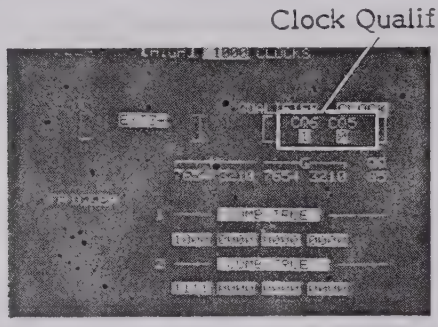


Fig. 5-91 HIGH Mode Clock Qualifiers

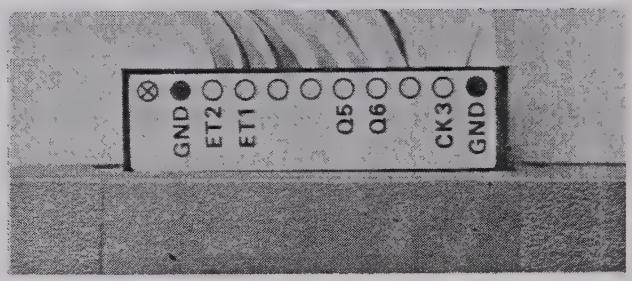


Fig. 5-92 Probe I Inputs

The clock qualifiers and the external clock signal must stand in certain timing relationship. Otherwise, the sampling clock may contain spikes in the sampling clock, spikes that will lead the recording of extraneous data items.

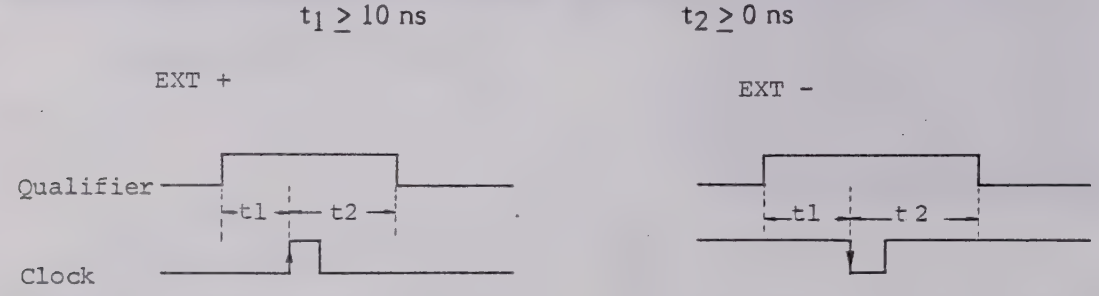


Fig. 5-93 Clock and Clock Qualifier Timing

5-7 DELAY

The VP-3662A Logic Analyzer offers two kinds of delay functions : CLOCK DELAY and EVENT DELAY.

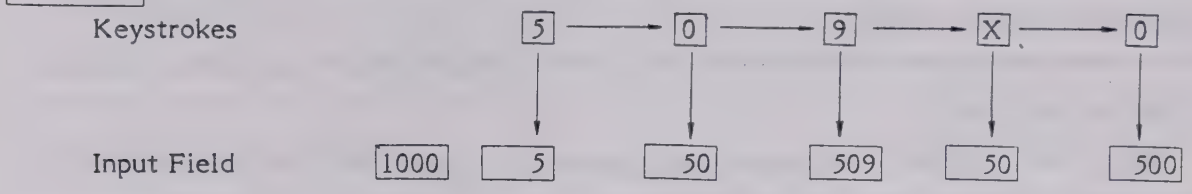
(1) CLOCK DELAY

The clock delay functions of the MAIN and HIGH modes, while similar, act independently. The number in their particular DELAY input field tells the instrument how long to continue recording data after it has detected data matching the final trigger word. For example, a count of "0" tells the instrument to stop immediately, making the triggering data item the last item displayed. On the other hand, a count of "500" places it at the midpoint of the instrument's 1000-place memory, enabling the user to examine the logic states leading up to and following the triggering data. A TIMING display indicates the position of the triggering data with a dotted line.

The CLOCK DELAY is set just like any other input field : use the EDIT keys (17)-(20) to activate the blink and shift it to the CLOCK DELAY input field. Then use the decimal keys 0-9 to enter the count.

Note : Use the "X" key (6) to correct typing mistake ; it deletes previously enterd keystrokes one at a time.

Example



(a) MAIN mode CLOCK DELAY

i. 32ch trace mode

Once the instrument has found data items matching all four trigger words, it continues to record until it counts the specified number of sampling clock pulses from the EXT1 clock input.

ii. 16ch(1) trace mode

This trace mode features separate delays for the synchronous (Probes D and C) and the asynchronous (Probes B and A) groups of channels. When the trigger function for each group has found data items matching all four trigger words, its clock delay starts counting. When its count matches the specification in the corresponding input field, the instrument stops the acquisition for that particular group.

iii. 16ch(2) trace mode

This trace mode features separate clocks for the two groups of channels (Probes D and C vs. Probes B and A). Once the trigger function has found data items matching all four trigger words, the D and C group continues recording until it counts the specified number of sampling clock pulses from the EXT1 clock input. The B and A group starts and stops data recording at the same time with the D and C group.

NOTE

(1) In any of the modes described above, the operation may be altered by specifying a linking trigger (for example, DC TRIG) or the GLITCH trigger.

(2) When using the TRACE 1 x 2 x 3 x 4 or TRACE 1 · 2 · 3 · 4 trigger options, enter the number of data items to be stored in the CLOCK DELAY input field. The count can be anywhere between 0 and 65,535 ; larger numbers are not accepted.

(b) HIGH mode CLOCK DELAY

Once the instrument has found data items matching both trigger words, it starts counting and stops storing data when it has reached the number specified in the CLOCK DELAY field.

NOTE

When the MAIN mode trace option is TRACE or BUS, the HIGH CLOCK DELAY input field accepts no input.

(2) EVENT DELAY

The EVENT DELAY function is only available for synchronous measurement in the MAIN mode---in other words, for all MAIN mode probes in the 32ch and 16ch(2) modes and for Probes D and C in the 16ch(1) mode.

Setting the EVENT DELAY uses the same procedure as the CLOCK DELAY. Fig. 5-94 shows the EVENT DELAY input field for the 32ch trace mode.

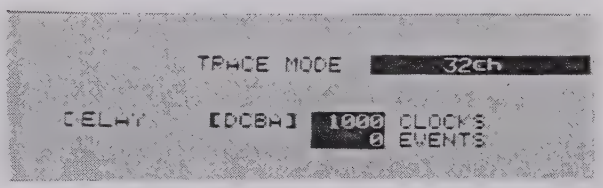


Fig. 5-94 EVENT DELAY (32ch Trace Mode)

The instrument counts the number of times it reaches the fourth trigger level (the "event") for the number specified in the EVENT DELAY input field. Then, when it reaches this level one further time, it activates the CLOCK DELAY function.

This option is only available for six trigger options :

(a) COMB 1 x 2 x 3 x 4

For this trigger option, the "event" is the detection of a data item matching the fourth trigger level (once the instrument has found data items matching the first three trigger levels sequentially). When the count exceeds the one in the EVENT DELAY input field, the instrument switches to the CLOCK DELAY function.

(b) COMB 1 • 2 • 3 • 4

For this trigger option, the "event" is the detection of a sequence of four consecutive data items matching the four trigger levels. When the count exceeds the one in the EVENT DELAY input field, the instrument switches to the CLOCK DELAY function.

(c) TRACE 1 x 2 x 3 x 4

For this trigger option, the "event" is the detection of a data item matching the fouth trigger level (once the instrument has found data items matching the first three trigger levels sequentially).

The instrument stores this data item and, when the count exceeds the one in the EVENT DELAY input field, switches to the CLOCK DELAY function. For example, if the EVENT DELAY is 100 and the CLOCK DELAY is 500, the instrument stores a total of

(100 + 1) + 500 = 601 data items.

(d) TRACE 1 · 2 · 3 · 4

For this trigger option, the "event" is the detection of a sequence of four consecutive data items matching the four trigger levels. The instrument stores this sequence of data items and, when the count exceeds the one in the EVENT DELAY input field, switches to the CLOCK DELAY function.

(e) BUS 1 x 2 x 3 x 4

For this trigger option, the EVENT DELAY functions the same as in (a).

(f) BUS 1 · 2 · 3 · 4

For this trigger option, the EVENT DELAY functions the same as in (b).

NOTE

The count can be anywhere between 0 and 65,535--with "0" meaning "no delay".

5-8 FILTER

Available only for Probes B and A and only in the 16ch(1) mode, this option tells the instrument to ignore data items matching the trigger word unless they are repeated consecutively at the number of times given in the FILTER input field. This option is designed to prevent transient matches---such as those arising from glitches or channel skew ---from accidentally triggering the instrument.

Note : "Channel skew" refers to the time lag between channels. Even if all channels have identical signals, the sampling circuits inside the logic analyzer will introduce timing differences on the order of nanoseconds between channels. The "channel skew factor" is the maximum timing difference among all channels.

Fig. 5-95 illustrates how this works. Matching the trigger word "all HIGH" are the portions between 1 and 3 and between 7 and 10. Specifying a filter of 3, however, tells the instrument not to interpret such matches as triggers unless they are at least 3 clock intervals long. As a result, the instrument will place the trigger point at 10.

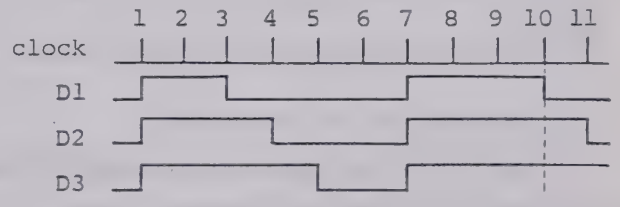


Fig. 5-95 FILTER Operation

Applications

This filter operation is necessary because there is no timing relationship between the incoming data and the internal clock. Such independence means that the instrument sometimes samples the data at a transition point, a point where the signal is either rising or falling. Depending on the exact timing, it may interpret the transition as either HIGH or LOW. Then again there is the problem of channel skew ; a transition might be stored in a clock interval adjacent to the proper one.

These two hardware limitations on the sampling process can, either separately or in combination, produce transient data items that match the trigger word so some way of blocking accidental triggering is required to ensure to accurate sampling.

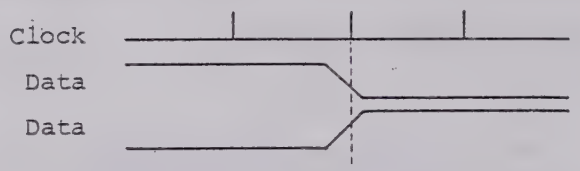


Fig. 5-96 Sampling Data Levels

5-9 CURSORS

The VP-3662A Logic Analyzer features two cursors, label C and R, which appear on all four types of displays (STATE, TIMING, MAP 1, and MAP 2). Each cursor has two cursor control keys : one that increases the address (⑬, ⑮) and one that decreases it (⑭, ⑯).

(1) STATE display

The STATE display uses the C-CURSOR position as the starting address for its 20-line display so the C-CURSOR is always at the top of the screen. The R-CURSOR only appears on the screen if it is positioned on one of these 20 lines.

(a) There are three ways to shift the C-CURSOR :

i. one step at a time

One stroke of the C-CURSOR key ⑮ increases the address by 1 ; pressig the other ⑯ decreaes it. Holding down either key provides repetitive shifting.

ii. twenty steps at a time

One stroke of the EDIT key ⑰ increases the address by one screenful (20 lines) ; pressing the opposing one ⑲ decreases it. Holding down either key provides repetitive shifting.

iii. by specifying the new address

The C-CURSOR position appears in an input field above the data (see Fig. 5-97). To shift the C-CURSOR to a specific memory location, enter the new address anywhere between 0 and 1000. Pressing the STATE key ② registers the change and calls the 20 lines of data starting at the C-CURSOR position to the screen.

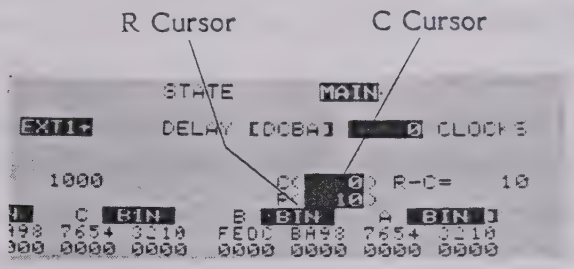


Fig. 5-97 CURSOR Input Fields

(b) There are two ways to shift the R-CURSOR :

i. one step at a time

One stroke of the R-CURSOR key (13) increases the address by 1 ; pressing the other one 14 decreases it. Holding down either key provides repetitive shifting.

ii. by specifying the new address

The R-CURSOR position appears in an input field above the data (see Fig. 5-97). To shift the R-CUROSR to a specific memory location, enter the new address and press the STATE key (2) to register the change.

(c) Using the cursors

Next to the two cursor input fields on the display (see Fig. 5-97), the instrument gives the difference betwen the two cursor positions. This number tells the user immediately the number of steps or clock intervals between the two data lines marked with the cursors.

(2) TIMING display

The CURSOR control keys (13) - (16) shift the two cursors through the memory locations 0-1000.

When the display is magnified (H x 4 , H x 8 , H x 16) so that only a portion of the 1000 data lines appear on the screen (we will call such partial display a "page"-- the size of a page depends on the magnification factor), shifting the C-CURSOR off the screen (off the "page") will bring in the next line of data. The R-CURSOR only appears on the screen if it is positioned in the "page" currently on the screen.

(a) There are three ways to shift the C-CURSOR :

i. one step at a time

One stroke of the C-CURSOR key (15) increases the address by 1 ; pressing the other one (16) decreases it. Holding down either key provides repetitive shifting.

ii. one "page" at a time

The EDIT keys (17), (19) shift the display to adjacent "pages". (This only has meaning for the magnified or partial displays.)

iii. by specifying the new address

The C-CURSOR position appears in an input field above the data (see Fig. 5-98). To shift the C-CURSOR to a specific memory location, enter the new address anywhere between 0 and 1000---and press the TIMING key (3) to register the change. If the new position is off the current "page", the instrument will shift the display to place the C-CURSOR on the lefthand margin of the screen.

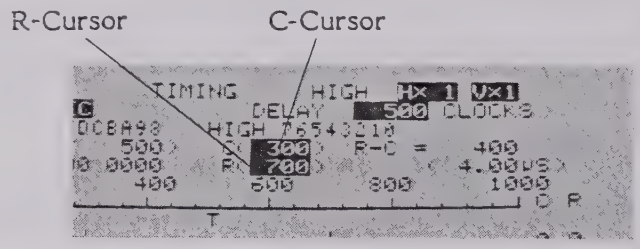


Fig. 5-98 CURSOR Input Fields

(b) There are two ways to shift the R-CURSOR :

i. one step at a time

The R-CURSOR keys (13), (14) shift the R-CURSOR position one memory address at a time in the same manner a their C-CURSOR counterparts.

ii. by specifying the new address

The R-CURSOR position appears in an input field above the data (see Fig. 5-98). To shift the R-CURSOR to a specific memory location, enter the new address and press the TIMING key (3) to register the change.

(c) Using the cursors

Next to the two cursor input fields on the display (see Fig. 5-98), the instrument gives the difference between the two cursor positions and its time equivalent. The user knows immediately the time interval between the two data lines marked with the cursors.

(3) MAP 1 display

The MAP 1 display maps all 1000 data items from Probes D and C onto a single dot grid, indicating the cursor positions with a plus (+) for C and an asterisk (*) for R. Shifting the cursors about the display helps the user analyze activity on the microprocessor's address bus.

(a) There are two ways to shift the C-CURSOR (+) :

i. one step at a time

The C-CURSOR keys ⑮, ⑯ shift the C-CURSOR position about the displayed data one memory address at a time.

ii. one "page" at a time

The EDIT keys ⑰, ⑲ shift the display to adjacent "pages". (This only has meaning for the magnified or partial displays.)

iii. by specifying the new address

The C-CURSOR position appears in an input field above the data (see Fig. 5-99). To shift the C-CURSOR to a specific memory location, enter the new address---anywhere 0 and 1000---and press the TIMING key ③ to register the change. If the new position is off the current "page", the instrument will shift the display to place the C-CURSOR on the lefthand margin of the screen.

(b) There are two ways to shift the R-CURSOR

i. one step at time

The R-CURSOR keys ⑬, ⑭ shift the R-CURSOR position about the displayed data one memory address at a time.

ii. by specifying the new address

The R-CURSOR position appears in an input field above the data (see Fig. 5-99). To shift the R-CURSOR to a specific memory location, enter the new address and press the MAP key ④ to register the change.

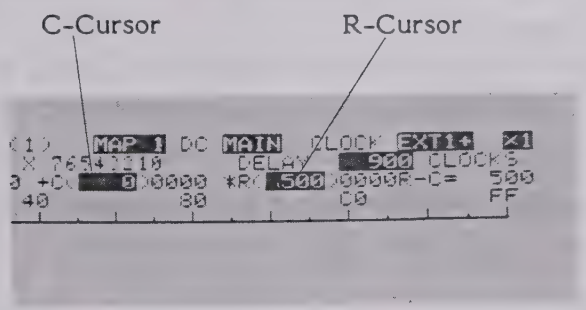


Fig. 5-99 CURSOR Input Fields

(c) Using the cursors

The cursors are used to mark points of interest on the display for closer examination with the STATE display mode. For example, when a microprocessor suddenly jumps to an address that is not suppposed to, the jump is immediately obvious on the MAP 1 display. After positioning the cursors in the vicinity of the jump, the user can then search for the cuases of this erratic behavior using all the data available in th STATE display mode.

(4) MAP 2 display

The MAP 2 display is limited to the 250 data items starting at the memory address given by the C-CURSOR, which it always places at the lefthand edge of the screen. The R-CURSOR---the same asterisk (*) used by MAP 1---is then used to analyze the data.

(a) There are three ways to shift the C-CURSOR

i. one step at a time
Use the C-CURSOR keys (15) and (16).

ii. 250 memory locations at a time
Use the EDIT keys (17) and (19).

iii. by specifying the new address
Enter the new C-CURSOR position in the input field above the data and press the MAP key (4) to register the change.

(b) There are two ways to shift the R-CURSOR

i. one step at a time
Use the R-CURSOR keys (13) and (14).

ii. by specifying the new address
Enter the new R-CURSOR position in the input field above the data and press the MAP key (4) to register the change.

5-10 SCROLLING

The VP-3662A Logic Analyzer's STATE display features a scrolling function.

(1) Scrolling up

Pressing the righthand C-CURSOR key (15) (see Fig. 5-100) once shifts the data display up one line. Pressing it continuously provides repetitive scrolling. It is also possible to scroll by "pages" (in this case, a "page" is defined as 20 lines of data) ; pressing the righthand EDIT key (17) (see Fig. 5-100) shifts the data display up to reveal the next 20 lines of data.

(2) Scrolling down

Pressing the lefthand C-CUSOR key (16) (see Fig. 5-100) once shifts the data display down one line. Pressing it continuously provides repetitive scrolling. It is also possible to scroll by "pages" ; pressing the lefthand EDIT key (17) (see Fig. 5-100) shifts the data display down to reveal the next 20 lines of data.

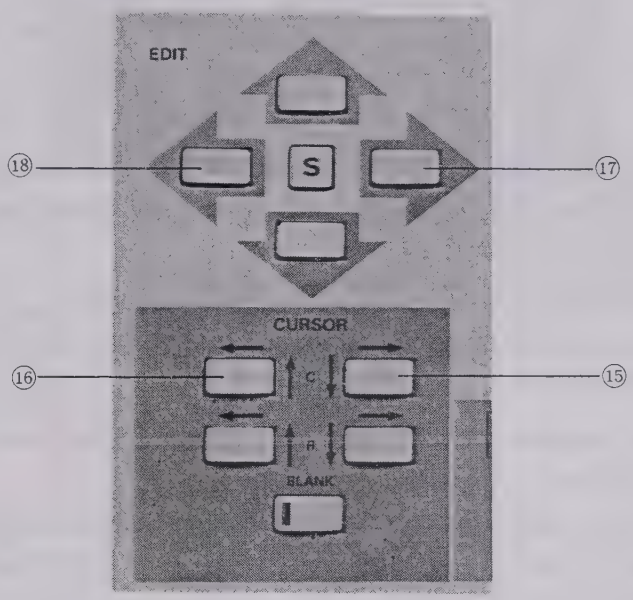


Fig. 5-100 Scrolling Keys

5-11 SCROLLING BY PAGES

The scrolling by pages just discussed in connection with the STATE display is also available for magnified TIMING displays and in the MAP 2 display mode. Needless to say, this feature greatly speeds up review of the stored data. The page size may vary, but "page" is defined as the current contents of the screen. To shift to an adjacent page, press one of the EDIT keys (17) or (19) (see Fig. 5-100). The former shifts to lower memory addresses ; the latter, to higher.

5-12 CHANNEL SEQUENCE

The stored data is initially displayed using the same channel sequence as it was acquired. In many cases, however, becomes expedient to rearrange the channels to speed up the analysis. The user can do this simply by changing the contents of the channel sequence input fields.

(1) STATE display

The channel sequence input field is set just like any other input field : use the EDIT keys (17)-(20) to activate the blink and shift it to the channel sequence input field. Enter the new sequence with the hexadecimal keys (5) and register it with the STATE key (2).

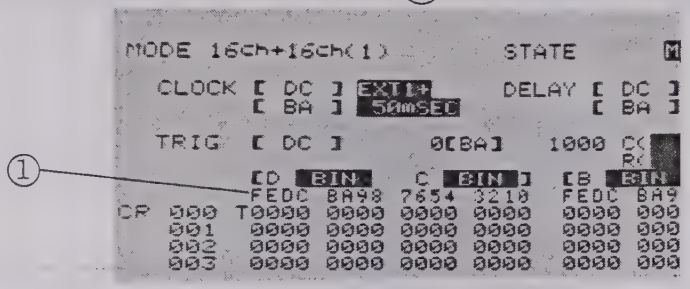


Fig. 5-101 Channel Sequence Input Field (STATE Display)

Note that the channels are in three groups of 16---one group for each of the probe pairs D&C, B&A, and H&G and can only be rearranged within the group.

NOTE

A STATE display containing HIGH mode data does not allow the user to change the channel sequences for the two MAIN mode probe pairs.

(2) TIMING Display

The TIMING display contains two channel sequence input fields (seeFig. 5-102). The one on the left ((1) in Fig. 5-102) contains the sequence for the lower half of the display ; the one on the right ((2) in Fig. 5-102), the higher half. Note that, as the vertical magnification factor increases (from Vx1 to Vx2 to Vx4), the number of places available decreases (from 8 to 4 to 2).

The channel sequence is set just like with any other input field : use the EDIT keys (17) -(20) to activate the blink and shift it to the channel sequence input field. Enter the new sequence with the hexadecimal keys (5) and register it with the TIMING key (3). Note that, with the 16ch(1) trace mode, it impossible to put both MAIN and HIGH mode data on the same TIMING display. It is not possible, however, to mix the sequences ; the upper and lower halves of the display remain independent.

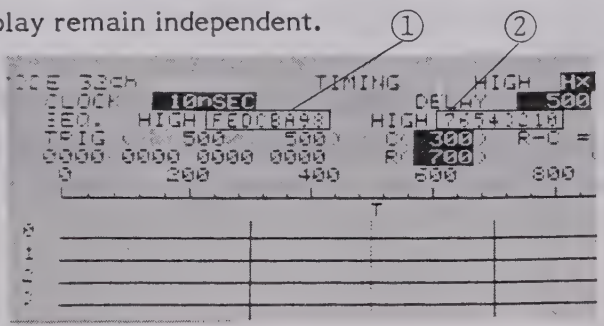


Fig. 5-102 Channel Sequence Input Field (TIMING Display)

(3) MAP 1 display

Since the MAP 1 display is limited to the data from the MAIN mode probes D and C, those 16 channels are the only ones that can be rearranged. The two input fields shown in Fig. 5-103 contain the channel sequences for the Y- and X-coordinates. Although divided into two groups in this way, the 16 channels may be freely rearranged.

The channels sequence is set just like any other input field : use the EDIT keys (17)-20 to activate the blink and shift it to the channel sequence input field. Then enter the new sequence with the hexadecimal keys (5) and register it with the MAP key (4).

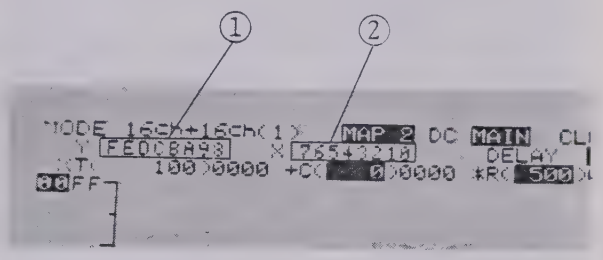


Fig. 5-103 Channel Sequence Input Field (MAP 2 Display)

(4) MAP 2 display

As far as channel sequence goes, the MAP 2 display is identical to the MAP 1 one : the data comes from Probes D and C, the first 8-place input field ((1) in Fig. 5-103) gives the Y-coordinate, and the second input field (2) in Fig. 5-103) gives the X-coordinate. Even the procedure for changing the sequence is identical.

5-13 POLARITY

The primary purpose of this function is to change signals using negative logic into ones using positive logic. To signify to the user that the polarity for a particular channel has been reversed, the instrument displays the channel number in "reverse video" (black on green instead of the normal green on black).

(1) STATE display

Changing the polarity first involves using the EDIT keys (17)-(20) to activate the blink, shifting it to the channel sequence input field shown in Fig. 5-101, and then shifting it through the input field with the C-CURSOR keys (15) and (16) to the desired channel. Pressing the [0] key (8) and the STATE key (2) reverses the polarity of the channel data. Pressing the [1] key (7) and the STATE key (2) restores them to the original polarity.

NOTE

A STATE display containing HIGH mode data does not allow the user to change the polarity of the MAIN mode channels.

(2) TIMING Display

Changing the polarity first involves using the EDIT keys (17)-(20) to activate the blink, shifting it to the channel sequence input field shown in Fig. 5-102, and then shifting it through the input field with the C-CURSOR keys (15) and (16) to the desired channel. Pressing the [0] key (8) and the TIMING key (3) reverses the polarity of the channel data. Pressing the [1] key (7) and the TIMING key (3) restores them to the original polarity.

(3) MAP Display

Changing the polarity first involves using the EDIT keys (17)-(20) to activate the blink, shifting it to the channel sequence input field shown in Fig. 5-103, and then shifting it through the input field with the C-CURSOR keys (15) and (16) to the desired channel. Pressing the [0] key (8) and the MAP key (4) reverses the polarity of the channel data. Presing the [1] key (7) and the MAP key (4) restores them to the original polarity.

5-14 BLANKING

This function enables the user to suppress the display of unwanted or irrelevant data. Activated by the BLANKING key (12), it is only available when the blink is not on the screen. When the light in the BLANKING key is lit, pressing the cursor keys (13) and (15) erases data from the screen while pressing the corresponding (14) and (16) restores it.

(1) STATE display

(a) MAIN mode data only

The instrument assigns the cursor pair (15) and (16) to Probes D and C and the other pair (13) and (14) to Probes B and A. Pressing the first member of the cursor pair erases the leftmost data item for the probe pair ; pressing the second restores the data. Holding down one of these keys produces a repetition effect.

(b) HIGH mode data

A STATE containing HIGH mode data does not allow the user to suppress any of the MAIN mode data. The suppress/restore function is limited to the HIGH mode data (cursor keys (13) and (14), respectively).

(2) TIMING display

The instrument assigns the cursor pair (15) and (16) to upper half of the display and the other pair (13) and (14) to lower half. Pressing the first member of the cursor pair erases the bottom data item from that half of the display ; pressing the second restores it.

Note : This function is independent of the vertical magnification ; it always suppresses starting from the bottom for each 8-channel data. Therefore, there will be a time lag if there are only four or two channels per screen half.

(3) MAP displays

The BLANKING function is not available for the MAP displays.

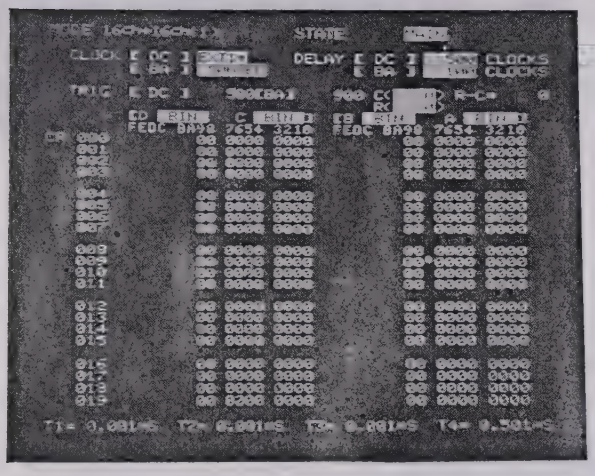


Fig. 5-104 BLANKING (STATE Disply)

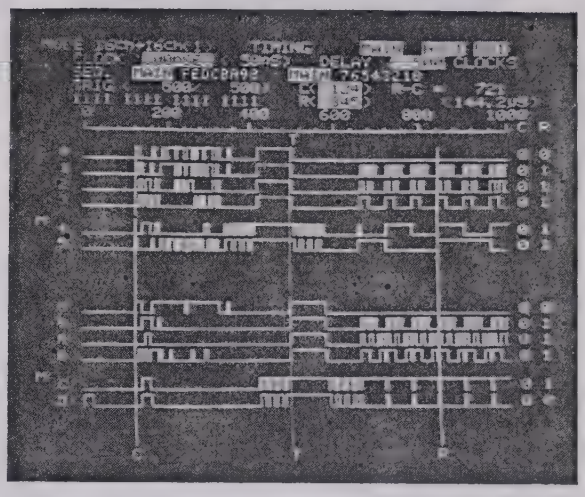


Fig. 5-105 BLANKING (TIMING Display)

5-15 MEASURING TRIGGER TIME INTERVALS

This function automatically measures the time required to find data items matching each of the four trigger levels and displays the results, T_1, T_2, T_3 and T_4 at the bottom of the screen. Thus the user can tell at a glance how long a particular software segment takes to execute. This function is, however, available oly for hte MAIN mode synchronous measuremnts--that is, for Probes D through A in trace modes 32ch and 16ch(2), but only for Probes D and C in the 16ch(1) trace mode.

(1) COMB 1 x 2 x 3 x 4

(a) EVENT DELAY = 0

The first three times, T_1, T_2 and T_3 give the time intervals between triggering data at one level and the next. T_4 gives the time interval between the detection of a data item matching the fourth trigger word and the end of the CLOCK DELAY period.

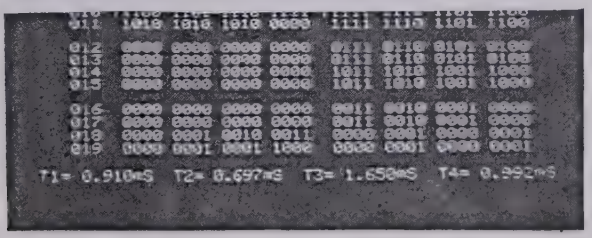


Fig. 5-106 Trigger Times (Example 1)

(b) EVENT DELAY ≥ 1

The instrument starts time measurement when it has found data items matching all four trigger words. T_1 then gives the time interval between the first two matches found for fourth trigger word ; T_2 , the interval between the first match and the end of the CLOCK DELAY period.

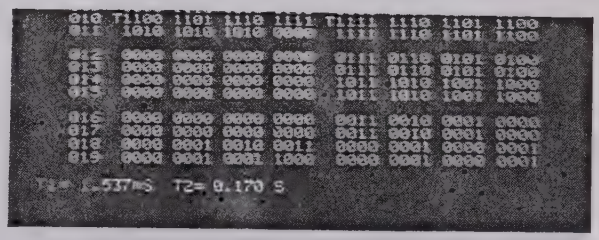


Fig. 5-107 Trigger Times (Example 2)

(2) COMB 1 · 2 · 3 · 4

(a) EVENT DELAY = 0

The instrument performs no time measurement functions.

(b) EVENT DELAY ≥ 1

The instrument performs the same time measurement functions as for COMB 1 x 2 x 3 x 4 .

(3) TRACE 1 x 2 x 3 x 4

(a) EVENT DELAY = 0

The instrument starts time measurement when it has found data items matching all four trigger words. T_1 then gives the time interval between the first two matches found for fourth trigger word ; T_2 , the interval between the first match and the end of the storage of he specified number of data in the CLOCK DELAY field.

(b) EVENT DELAY ≥ 1

T_1 gives the time interval between the first two matches found for fourth trigger word. T_2 gives the interval between the first match and the end of the detection of the specified number of events in the EVENT DELAY field. T_3 gives the time interval between the end of T_2 and the succeeding match. T_4 gives the interval between the first of the T_3 match and the end of the storage of the specified number of data in the CLOCK DELAY field.

(4) TRACE 1 · 2 · 3 · 4

(a) EVENT DELAY = 0

The instrument performs the same time measurement functions as for TRACE 1 x 2 x 3 x 4 .

(b) EVENT DELAY ≥ 1

The instrument performs the same time measurement functions as for TRACE 1 x 2 x 3 x 4 .

NOTES

The results of these time measurement appear at the bottom of the STATE and MAP displays.

The resolution is 1 μs. The accuracy is within ±2 μs in the range 1 μs-1 ms.

The maximum time that can be measured is 99.999 seconds. Times longer than this appear as >99.999 S.

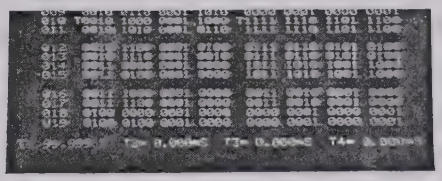


Fig. 5-108 Time Overrange

5-16 REFERENCE MEMORY

In addition to its MAIN memory which holds the acquired MAIN mode data, the Logic Analyzer has a REFERENCE memory into which the contents of the MAIN memory can be transferred for comparison with later sets of acquired MAIN mode data. This memory is only available for the 32 channels of the MAIN mode (Probes D through A) and has a storage capacity of 1001 bits per channel.

To store MAIN mode data in the REFERENCE memory, press the MAIN→REF key. Pressing this key copies all of the data from Probes D through A which is currently in the MAIN memory into the REFERENCE memory.

(1) Displaying the contents of the REFERENCE memory

(a) STATE display

Use the EDIT keys (17)-(20) to activate the blink and shift it to the displaying memory selector input field (see Fig. 5-109). Switch the contents to REF with the EDIT S key and then register the change with the STATE key.

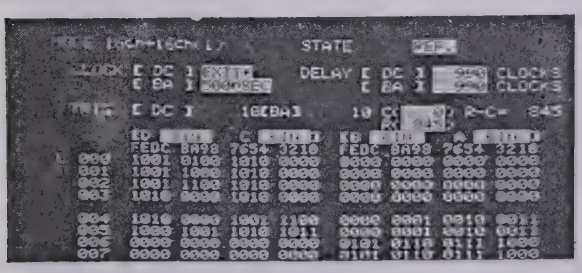


Fig. 5-109 Reference Memory Data (STATE Display)

(b) The TIMING display

Timing display only has access to the 16ch(1) trace mode reference data for Probes B and A. There are two input fields (① and ② in Fig. 5-110) : specifying REF in the first puts the reference data for Probe B on the lower half of the display ; specifying REF in the second puts the reference data for Probe A on the upper half. To specify REF, use the EDIT S key to switch the contents of the input field to REF and then register the change with the TIMING key.

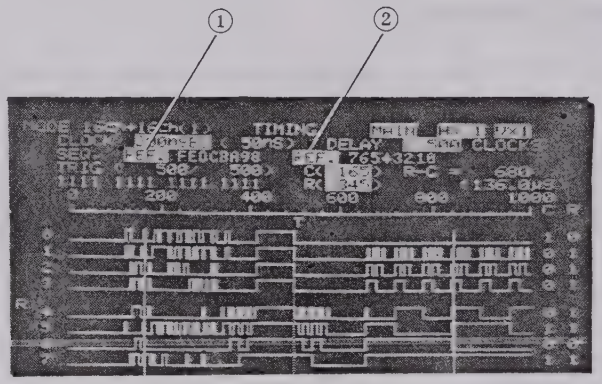


Fig. 5-110 Reference Memory Data
(TIMING Display)

(c) MAP displays

The MAP displays have access to the reference data for Probes D and C. Use the EDIT S key to switch the contents of the displaying memory input field to REF and then register the change with the MAP key.

(2) Alternately displaying main and reference data

The user can also ask for an alternating display of the contents of the MAIN and REFERENCE memories for the STATE and MAP displays. Use the EDIT S key to switch the contents of the corresponding input field to M/R and then registering the change with the STATE or MAP key. The instrument will then alternately display the contents of the two memories and signal which memory is currently on the screen by displaying either MAIN or REF in the input field.

Pressing the STAE or MAP key a second time stops the alternating display and leaves the current memory data on the scrreen.

NOTE

The acquisition conditions (CLOCK and DELAY) on the screen are for the MAIN memory and not the REFERENCE memory even when the contents the REFERENCE memory are displayed.

5-17 SEARCH

Available for all display modes, the search function enables the user to quickly find data matching his specifications. In the STATE display mode, this function also marks all such data items with an "S", counts them, and supplies the addresses of the first and last one.

To activate this function, call up the SEARCH menu (see Fig. 5-111) with the MENU key, press the EDIT key (18) to start the input field ((1) in Fig. 5-111) blinking, and use the EDIT S key to switch the contents to ON.

To specify the data parameters, preses the EDIT key (18) once more to shift the blink to data input field and enter the data with the hexadecimal or binary keys.

To register the new values, press the corresponding display mode key (STATE, TIMING, or MAP).

To deactivate the SEARCH function, set the topmost input field to OFF.

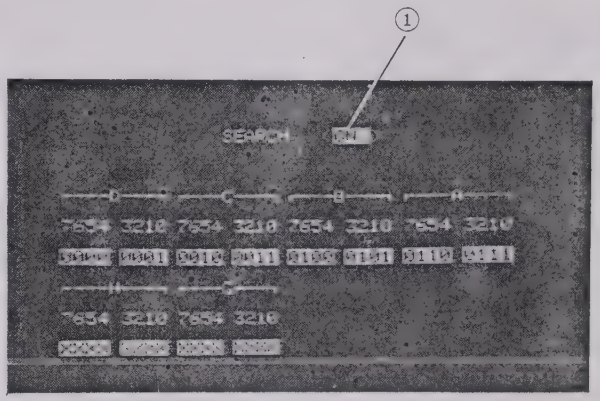


Fig. 5-111 SEARCH Menu

(1) STATE display

Fig. 5-112 shows the results of a search. In the STATE display mode, the search function marks each occurrence with an "S" and, at the bottom of the screen, gives the address of the first one found ("START"), the address of the last one found ("END"), and a count ("TOTAL").

When the STATE display is on the screen, the STATE key takes on a new function : Pressing it shifts the first S-marked data on the screen and then the next S-marked data to the C-CURSOR position.

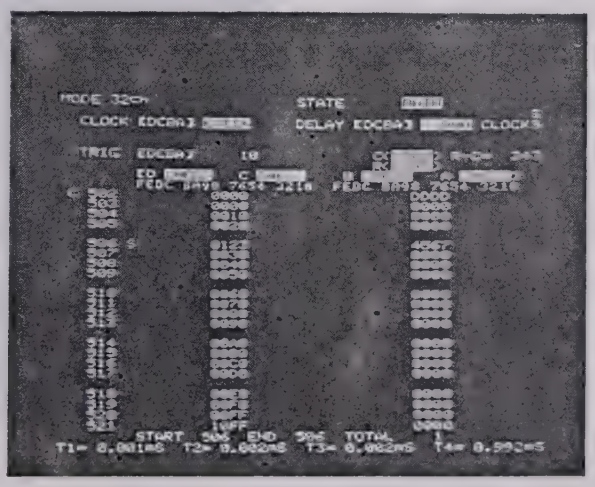


Fig. 5-112 SEARCH Function (STATE Display)

(2) TIMING display

When the TIMING display is on the screen, pressing the TIMING key shifts the C-CURSOR to the next data item matching the SEARCH menu specifications.

(3) MAP 1 display

When the MAP 1 display is on the screen, pressing the MAP key shifts the C-CURSOR (indicated with a "+") to the next data item matching the SEARCH menu specifications.

(4) MAP 2 display

When the MAP 2 display is on the screen, pressing the MAP key shifted the C-CURSOR (the lefthand margin of the display) to the next data item matching the SEARCH menu specifications.

NOTE

If there is no data item matching the SEARCH menu specifications in the memory, pressing the display mode key (STATE, TIMING or MAP) will have no effect.

5-18 ZOOMING

"Zooming" is a tracing method that uses a relatively slow clock to acquire the general flow together with a faster clock to "zoom in" on the particular data of interest. It makes use of the VP-3662A Logic Analyzer's ability to analyze the same data using two separate clocks (one for the MAIN mode, another for the HIGH mode) in the 16ch(1) trace mode and display the stored data together on the same TIMING display.

The procedure is simple : connect the 16ch(1) trace mode Probes B and A and the HIGH mode Probes H and G to the same data. Set two different sampling speeds for the MAIN and HIGH modes, but use the same trigger conditions and the same DELAY. A DELAY of 500 will align the triggers for both modes in the center of the TIMING display, but the time scales for the upper and lower halves will be different. For example, setting the input fields (① and ② in Fig. 5-113) to HIGH and MAIN, respectively, will put the MAIN mode data above that for the HIGH mode.

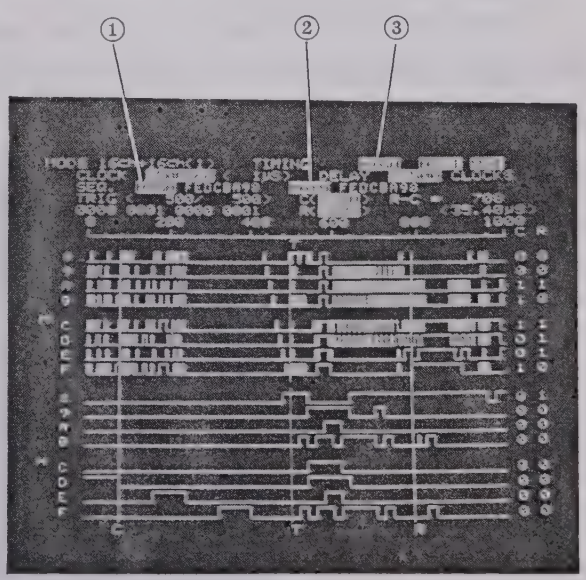


Fig. 5-113 Zooming

Note : The calculated time difference between the two cursors will depend on the contents of the input field marked (3) in Fig. 5-113 : [HIGH] tells the instrument to measure the time using the HIGH mode clock ; [MAIN], the MAIN mode one.

Although the instrument stores a full 32 channels of data---16 channel per clock mode---in its memory, it can only display 16 channels---8 per clock mode---at a given time on a TIMING display. To examine all 32 channels, simply change the channel sequences.

SECTION VI
DATA ACQUISITION

This Section starts with the general precautions to be observed when acquiring data and then goes on to discuss data acquisition for each of the three trace modes.

6-1 GENERAL PRECAUTIONS

(1) Preparation

The VP-3662A Logic Analyzer gets its data from the probes. These probes compare the raw data with the threshold voltage supplied by the logic analyzer to determine whether the signal is HIGH or LOW. The digital output from the voltage comparators then travels along the probe cables to the logic analyzer where it is digitlized using an internal or external clock. Thus, to ensure the accuracy of this data acquisition process, the following precautions must be observed :

(a) Applying the power

Always start the VP-3662A ahead of the system under test. Otherwise, Start-up current might flow from the instrument through the probes and disrupt the system's operations.

(b) Connecting the probe tips

Always connect the probe's ground lead to the ground of the system it is testing.

Ground all unused probe tips there as well. The high input impedance of the probes makes them highly susceptible to external induction effects and can lead to spurious inputs from probes that are left open. This is especially important for raw data with large amplitudes and for the HIGH mode probes.

(c) Threshold voltage

The reference the probe's voltage comparator uses to determine whether the data level is HIGH or LOW is the VP-3662A's threshold voltage. The data must have an amplitude at least 0.4 V above and below this level.

In additional to the standard TTL level of +1.40 V, the VP-3662A's threshold voltage may be set, in 50 mV steps, anywhere in the range of $\pm$6.35 V. when the data has a high noise level, a higher threshold voltage decreaess the risk of noise being mistaken for data.

(d) HIGH speed

Always use the HIGH mode probes with their probe tip leads twisted in pairs with their ground leads. (see Paragraph 5-4 and Fig. 5-13 for details)

(e) Probe types

The VP-3662A Logic Analyzer uses different types of probes for the MAIN and HIGH modes. Since there is absolutely no compatibility between the two types, always double-check the connections. (refer to the connection procedure in Paragraph 3-7)

(2) Asynchronous sampling

(a) Channel skew

Using the internal clock can sometimes lead to data entries which are offset by a bit even when two channels change levels at exactly the same time. (for details, refer to Paragraph 5-8)

(b) Detecting glitches

Glitches, by definition, are shorter than the clock interval. The normal SAMPLE mode often fails to record them because it only samples the input at the edge of the clock signal. Instead, use the [LATCH] mode. [LATCH] records everything between edges so is better able to catch glitches.

(c) Edge trigger

The HIGH mode trigger detection is made by edge trigger which only operates when the incoming data changes to match the trigger word for either level 1 or level 2. It does not operate, therefore, if the initial data already matches.

The MAIN mode is different ; only the level 1 of the sequential trigger acts as edge trigger.

(d) Choosing the internal clock

A faster clock increases the accuracy of the observations, but also shortens the time interval that can be monitored. The rule of thumb is that the clock frequency should be at least 10 times the frequency of the signal being monitored. For example, if the signal has a maximum period of 1 msec, the clock should be less than 100 μsec.

(3) Synchronous sampling

Synchronous sampling uses the system clock provided by the system under test. Therefore, the monitoring accuracy hinges on the accuracy of the clock input and the timing relationship between the clock and the data.

(a) Clock

When the external clock has a frequency above 10 MHz, make sure taht the clock probe has its clock lead and ground lead together as a twisted pair. Otherwide, the high impedance of the probe will lead to inductive effects that can adversely affect the clock.

(b) Set-up and hold times

The external clock must not be so fast as to interfere with the Logic Analyzer's set-up and hold times, two factors critical to obtaining true samples of stabilized data. (see Paragraph 5-4 (5))

6-2 32ch TRACE MODE

The 32ch trace mode provides synchronous measurement with a 20 MHz clock on 32 channels and synchronous or asynchronous measurement with a 100 MHz clock on an additional 16 channels.

(1) Applications

The 32ch trace mode is designed for the following types of applications :

* Multi-channel synchronous measurement
* Synchronous measurement of two systems with separate clocks
* Tracing of 8-bit or 16-bit bus activity at one clock speed while tracing hardware activity at a higher one

(2) MAIN mode operation

(a) Clock

This mode uses the CK1 input from probe E for the sampling clock. The user may specify either the rising or falling edge of the clock signal.

The maximum sampling frequency is 20 MHz.

(b) Data storage

The VP-3662A simultaneously stores 32 channels of data from probes D through A. It has a memory capacity of 1,001 bits per channel.

(c) Qualifiers

The Logic Analyzer uses the inputs CQ4-1 from probe E as clock qualifiers on the clock input CK1 from the same probe.

Data qualifiers enter through DQ2 and DQ1 on probe E.

(d) Triggering

The trigger functions operate on a total of 34 channels : the 32 data channels from Probes D through A and the 2 data qualifier inputs DQ2 and DQ1 from Probe E.

(e) Trigger functions

The following trigger functions are available :

* COMB 1 x 2 x 3 x 4
* COMB 1 · 2 · 3 · 4
* TRACE 1 x 2 x 3 x 4
* TRACE 1 · 2 · 3 · 4
* BUS 1 x 2 x 3 x 4
* BUS 1 · 2 · 3 · 4
* HIGH TRIG
* NOT USED

For further details, refer to Paragraph 5-5.

(3) HIGH mode operation

(a) CLock

This mode uses either its internal clock (setting range : 50 ms - 10 ns) or the CK3 input from probe I for the sampling clock. For the external clock, the user may specify either the rising or falling edge of the clock signal.

The maximum sampling frequency for synchronous measurement with an external clock (CK3) is 50 MHz. For asynchronous measurement, the instrument can operate with sampling frequencies up to 100 MHz.

(b) Data storage

The Logic Analyzer simultaneously stores 16 channels of data from probes H and G. It has a memory capacity of 1,001 bits per channel.

(c) Qualifiers

The user must choose between clock and data qualifiers ; they cannot be used together. The qualifier inputs come from Q6 ane Q5 on Probe I.

(d) Triggering

The trigger functions operate on a total of 18 channels : the 16 data channels from Probes H and G and the 2 qualifier inputs Q6 and Q5 from Probe I.

(e) Trigger functions

The following trigger functions are available :

T1

* COMB TRUE
* DCBA TRIG
* EXT1+
* EXT1-

T2

* COMB TRUE
* BUS
* DCBA TRIG
* EXT2-
* COMB FALSE
* GLITCH
* EXT2+

For further details, refer to Paragraph 5-5.

(4) Settings on menus

The VP-3662A assigns precedence to the MAIN mode menu.

Always change the settings in the order MAIN mode before HIGH mode. Otherwise, inconsistencies between the two menus may result in errors for those trigger functions (BUS, TRACE, and DCBA TRIG) which overlap both modes. For example, setting the HIGH mode trigger to DCBA TRIG and then setting the MAIN mode trigger to NOT USED will produce an error when the RUN key is pressed.

(5) Relationship between triggers for the two modes.

The triggers for the MAIN and HIGH modes can be either linked together or operate totally independently. Independent operation results for the following settings :

MAIN mode	HIGH mode
* COMB 1 x 2 x 3 x 4	* COMB TRUE
* COMB 1 • 2 • 3 • 4	* COMB FALSE
* NOT USED	* GLITCH
	* EXT±

Note : Specifying TRACE for the MAIN mode automatically disables all HIGH mode trigger settings.

All other combinations of trigger settings result in linked operation so require extreme care in supplying the data and selecting the trigger word.

(6) Displaying the stored data

The VP-3662A displays MAIN mode data in the STATE or the two MAP forms. For the HIGH mode data, it has the STATE and, provided that the data was stored using an internal clock, the TIMING forms.

Note : HIGH mode data entered with an external clock cannot be displayed as a TIMING diagram.

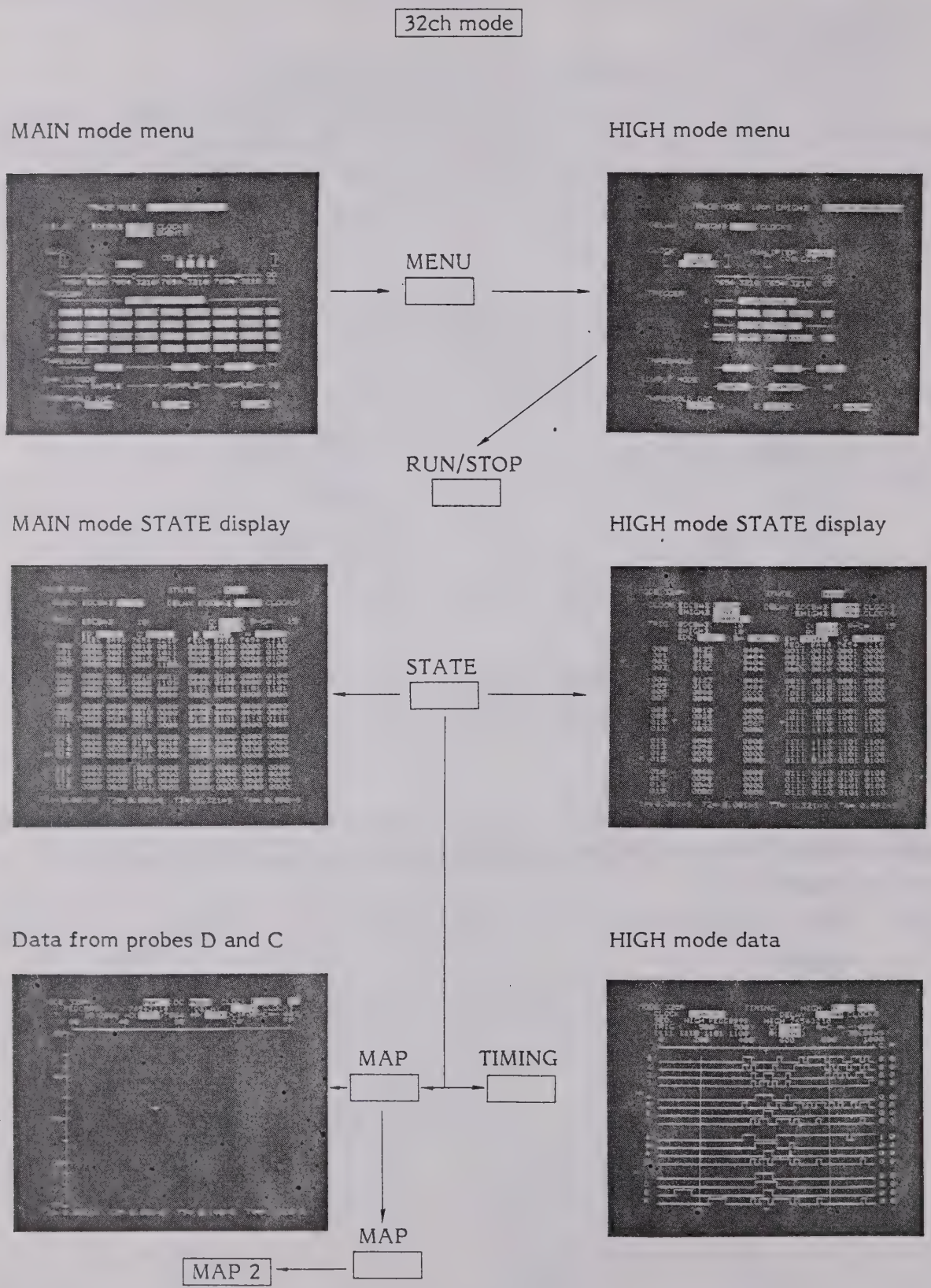


Fig. 6-1 Reading and Display 32ch Mode Data

6-3 16ch(1) MODE

The 16ch(1) trace mode divides the 32 MAIN mode channels into two 16-channel groups--one group for synchronous measurement and another for asynchronous measurement. There is, of course, a third group, the 16 HIGH mode channels. These may be used either synchronously or asynchronously.

(1) Applications

The 16ch(1) trace mode is designed for the following types of applications :

* Multi-channel timing analysis mainly for hardware
* synchronous measurement plus multi-channel analysis
* hardware analysis using two different clocks

(2) MAIN mode operation

(a) Clock

This mode uses the CK1 input from probe E as the sampling clock for the data from Probes D and C. The user may specify either the rising or falling edge of the clock pulse. The maximum sampling frequency is 20 MHz.
The data from Probes B and A uses an internal clock set in the range from 50 ms to 50 ns.

(b) Data storage

The VP-3662A stores the data from the two 16-channel groups separately. Since it uses separate trigger words, the groups can have separate stopping points as well.

(c) Qualifiers

The Logic Analyzer uses the inputs CQ4-1 from probe E as clock qualifiers on the clock input CK1 from the same probe to derive the sampling clock for Probes B and A.

Data qualifiers for Probes B and A enter through DQ2 and DQ1 on probe E.

(d) Triggering

The trigger functions operate on a total of 18 channels : the 16 data channels from Probes D and C and the 2 data qualifiers for Probes B and A (inputs DQ2 and DQ1 from Probe E).

(e) Trigger functions

The following trigger functions are available :

Probes D & C	PROBES B & A
* COMB 1 x 2 x 3 x 4	* COMB 1 x 2 x 3 x 4
* COMB 1 · 2 · 3 · 4	* GLITCH
* BA TRIG	* DC TRIG
* HIGH TRIG	* HIGH TRIG
* NOT USED	

NOTE

The DC TRIG for Probes B and A requires Probes D and C setting other than the BA TRIG or NOT USED.

For further details, refer to Paragraph 5-5.

(3) HIGH mode operation

Operation is exactly the same as for the 32ch mode, subject to a few restrictions on the trigger functions :

T1	T2
* COMB TRUE	* COMB TRUE
* DC TRIG	* COMB FALSE
* BA TRIG	* GLITCH
* EXT1+	* DC TRIG
* EXT1-	* BA TRIG
	* EXT2+
	* EXT2-

NOTE

Simultaneous selection of DC TRIG is not permitted. The GLITCH trigger is available only for data stored using an internal clock.

(4) Settings on menus

As already mentioned in connection with the 32ch mode, always change the settings in the order MAIN mode before HIGH mode.

(5) Relationship between triggers for the two modes

The triggers for the MAIN and HIGH modes can be either linked together or operate totally independently. Independent oepration results for the following settings :

Probes D and C	Probes B and A	HIGH mode
* COMB 1 x 2 x 3 x 4	* COMB 1 x 2 x 3 x 4	* COMB TRUE
* COMB 1 · 2 · 3 · 4	* GLITCH	* COMB FALSE
* NOT USED		* GLITCH
		* EXT±

Note : Specifying TRACE for the MAIN mode automatically disables all HIGH mode trigger settings.

All other combinations of trigger settings result in linked operation so require extreme care in supplying the data and selecting the trigger word.

For further details, refer to Paragraph 5-5.

(6) Displaying the stored data

The VP-3662A displays the data from Probes D and C in the STATE or the two MAP forms and that from Probes B and A in the STATE or TIMING forms. For the HIGH mode data, it has the STATE and, provided that the data was stored using an internal clock, the TIMING forms.

Note : Since it is possible to display the HIGH mode data on the same TIMING display with the data from Probes B and A, one application for the 16ch(1) mode is the multi-channel acquisition with Probes B and A using MAIN mode clock for a general picture of the general flow and then using the HIGH mode to "zoom in" on the portions of interest. This simultaneous display of the same data with two different time scales helps speed up the analysis.

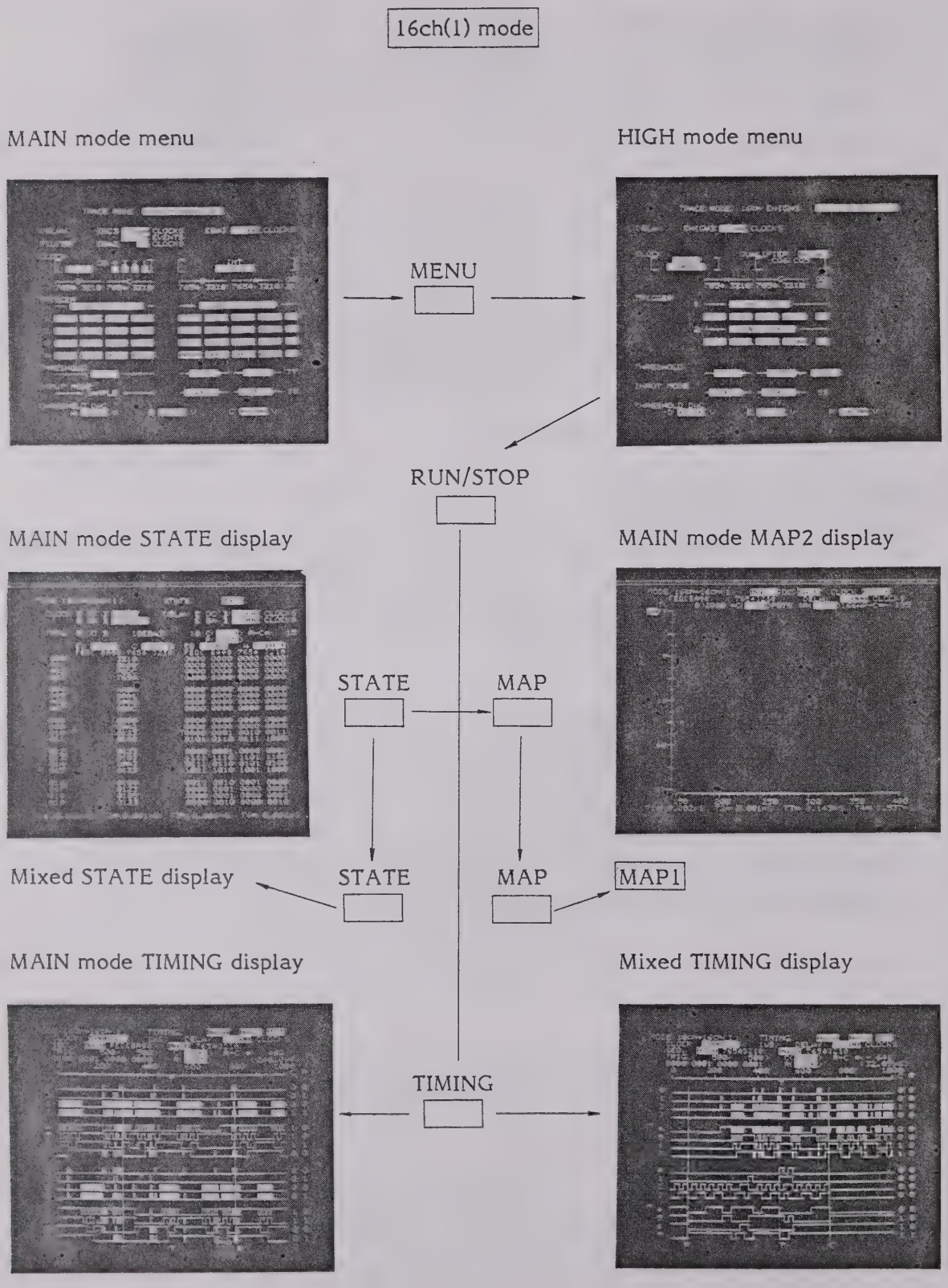


Fig. 6-1 Reading and Display 16ch(1) Mode Data

6-4 16ch(2) MODE

The 16ch(2) trace mode divides the 32 MAIN mode channels into two 16-channel groups for synchronous measurement with separate external clocks. There is, of course, a third group, the 16 HIGH mode channels. These may be used either synchronously or asynchronously.

(1) Applications

The 16ch(2) trace is designed for the following types of applications :

* synchronous analysis of three different systems using three different clocks
* synchronous analysis of two different systems using two different clocks coupled with hardware tracing at a higher clock speed

(2) MAIN mode operation

(a) Clock

This mode uses the CK1 input from probe E as the sampling clock for the data from Probes D and C. The user may specify either the rising or falling edge of the clock pulse.

The maximum sampling frequency is 20 MHz.

For the data from Probes B and A, the user may specify either CK1 or CK2 from Probe E. In addition, he may specify either the rising or falling edge of the clock pulse.

(b) Data storage

The VP-3662A stores the data from the two 16-channel groups separately.

(c) Qualifiers

The Logic Analyzer uses the inputs CQ4 and CQ3 from probe E as qualifiers on the sampling clock input CK1 from the same probe to derive the sampling clock for Probes D and C. Similarly, it uses the inputs CQ4 and CQ3 as qualifiers on the sampling clock input (CK1 or CK2) chosen as the sampling clock for Probes B and A.

Data qualifiers for Probes B and A enter through DQ2 and DQ1 on probe E using the same sampling clock as that chosen for Probes B and A.

(d) Triggering

Two external clock inputs can be completely independent. However, they are usually selected to have definite time relationship. When the two external clocks have vastly differnt periods or there is no synchronous relationship between them, the faulty trigger detection may be caused.

(e) Trigger functions

The following trigger functions are available :

* COMB 1 x 2 x 3 x 4
* COMB 1 · 2 · 3 · 4
* TRACE 1 x 2 x 3 x 4
* TRACE 1 ·2 · 3 · 4
* HIGH TRIG
* NOT USED

Note : The TRACE modes automatically set the Probe B and A sampling clock equal to that for Probes D and C.

For further details, refer to Paragraph 5-5.

(3) HIGH mode operation

Operation is exactly the same as for the 32ch mode, subject to a few restrictions on the trigger functions :

T1

* COMB TRUE
* DCBA TRIG
* EXT1+
* EXT1-

T2

* COMB TRUE
* COMB FALSE
* DCBA TRIG
* GLITCH
* EXT2+
* EXT2-

NOTE

Simultaneous selection of DCBA TRIG is not permitted.
The GLITCH trigger is available only for data stored using an internal clock.

(4) Settings on menus

As already mentioned in connection with the 32ch mode, always change the settings in the order MAIN mode before HIGH mode.

(5) Relationship between triggers for the two modes

The trigger functions operate totally independently for the two MAIN mode groupings as long as the user does not specify HIGH TRIG. Similarly, for the HIGH mode, everything except DCBA TRIG results in independent operation.

For details of what happens when the MAIN mode uses the HIGH TRIG or the HIGH mode uses the DCBA TRIG, refer to Paragraph 5-5.

(6) Displaying the stored data

The VP-3662P displays the MAIN data from Probes D and C in the STATE or the two MAP forms, but only in the STATE form for that from Probes B and A. For the HIGH mode data, it has the STATE and, provided that the data was sorted using an internal clock, the TIMING forms.

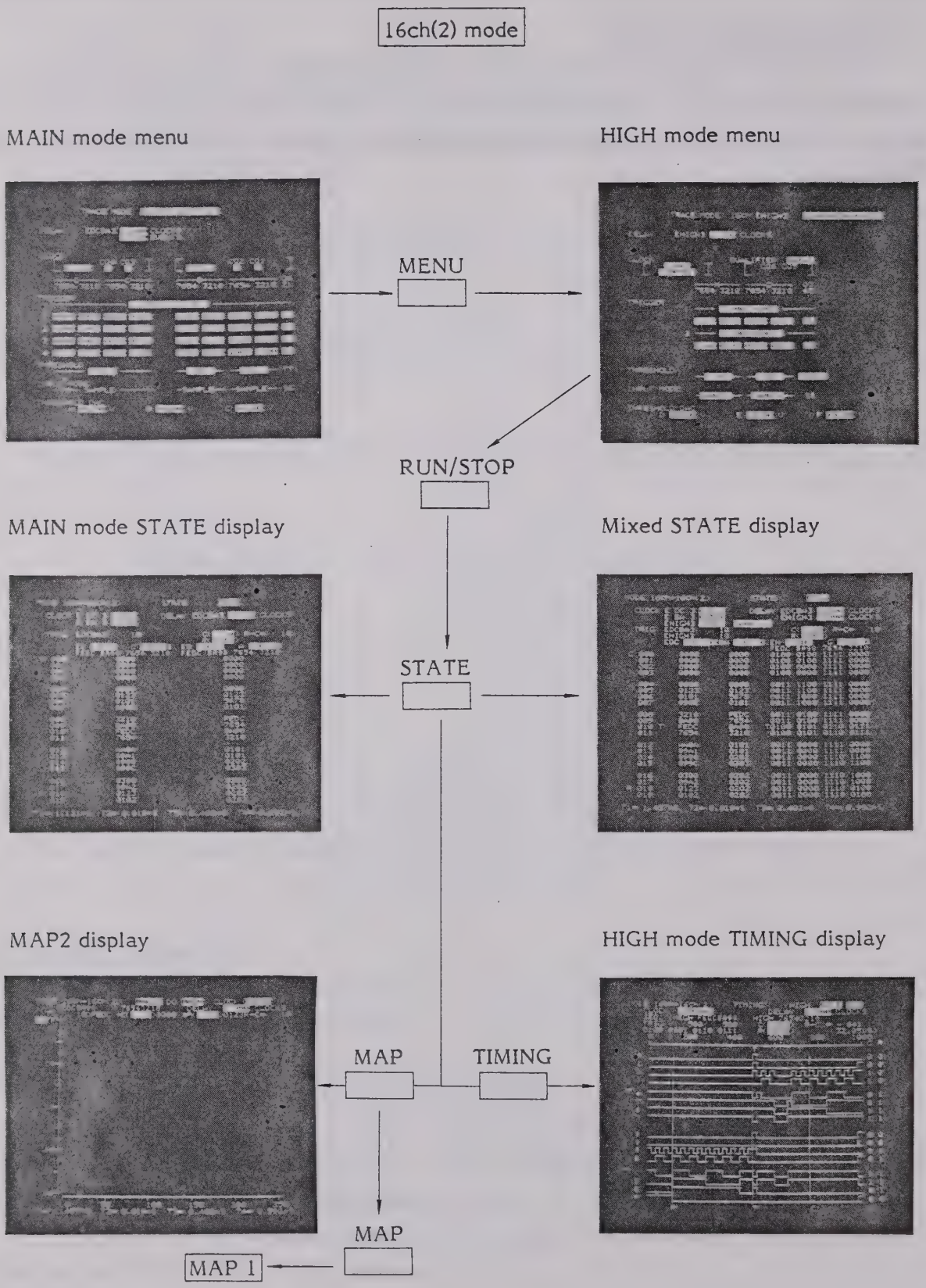


Fig. 6-3 Reading and Display 16ch(2) Mode Data

6-5 RESET IF

The RESET IF function, available only for the MAIN mode, compares the newly acquired data with the contents of the REFERENCE memory, looks at the conditions specified in the RESET IF portion of the SEARCH/RESET IF menu, and then either resumes tracing ("resets") or stops.

The SEARCH/RESET IF menu follows the HIGH mode menu in the cycle switched by the MENU key.

(1) Settings

(a) Reference data setting

Acquire the data which is to be used as the reference into the MAIN memory through the ordinary acquisition procedure in the MAIN mode.

Transfer the data into the REFERENCE memory by pressing the MAIN→REF key.

(b) Activate the RESET IF function

Press the S key until the input field opposite RESET IF (①in Fig. 6-4) reads ON.

(c) Specify the comparison mode

Use the S key to set = (equal) or = (not equal) in the MODE input field (②in Fig. 6-4).

= RESET IF EQUAL

If the newly acquired data matches that in the REFERENCE memory, the instrument resumes tracing. In other words, tracing continues until the match fails.

= RESET IF NOT EQUAL

Tracing continues until matching data enters.

(d) Specify the probes

The third input field, REF. (③in Fig. 6-4) specifies which probes are to be compared with the reference data. Type the probe letter(s) (among A, B, C and D in any sequence) with the hexadecimal keys.

To correct typing mistakes, press the X keys.

(e) Specify memory area

The AREA input fields C and R (⑤and ④in Fig. 6-4) specify the first and last memory addresses to be compared.

Example : Setting for comparison from address 0 to address 100.

C(0) R(100)

(2) Execution and display

Press the RUN/STOP key, and the data acquisition starts. When triggered, the newly stored data in the MAIN memory are displayed in a state table form and the comparison to the reference data is executed.

If the comparison condition (= or =) is satisfied, it resets and restarts the new data acquisition and repeats the same process. The number of resets is indicated at the position shown in Fig. 6-5.

The comparison stops when it fails to meet the condition and the resultant state table display is obtained on the screen with the failed data and its address at the top line (C-cursor position) on the state table.

The function also generates a negative logic output at the RESET terminal at the rear of the instrument. This signal can, for example, be used as the START signal for the system under test.

Using the RESET IF Function

MAIN→REF

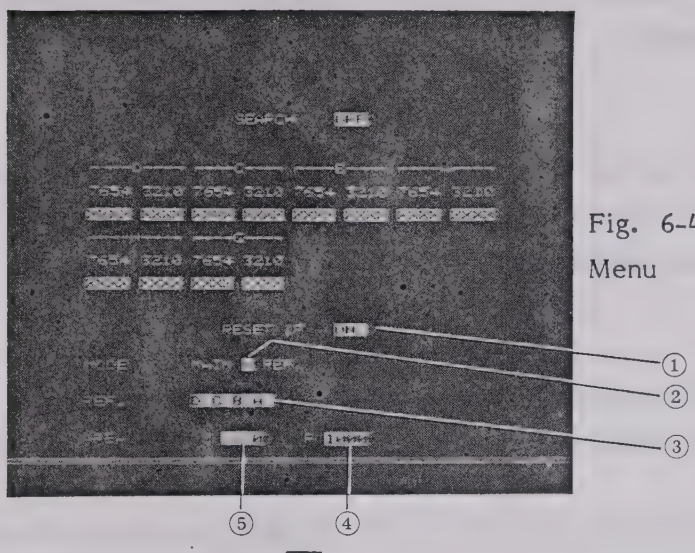


Fig. 6-4 SEARCH/RESET IF Menu

RUN/STOP key

RESET IF = [ ]

Number of Resets

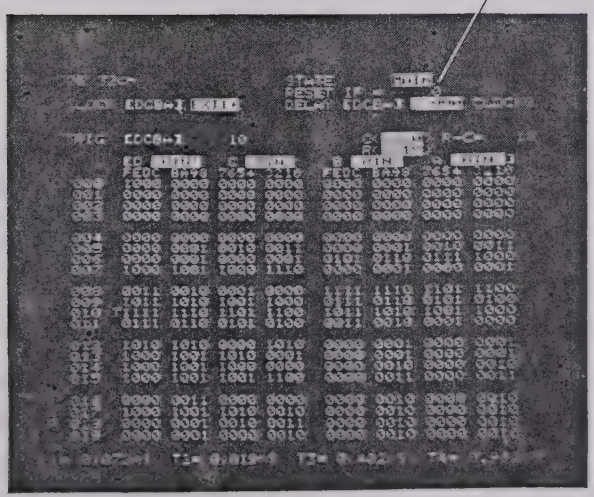


Fig. 6-5 Final (STATE) Display

6-6 REP/SINGLE key

This key determines whether the Logic Analyzer executes single acquisition or repetitive acquisition.

(1) SINGLE

When the light in the key is off (the "SINGLE" state), the instrument only acquires one set of data (1,001 bit/ channel) at the time the RUN/STOP key is pressed. The stored data is then available for display.

(2) REP (REPEAT)

When the light in the key is on (the "REP" state), the RUN/STOP key starts repetitive acquisition. The Logic Analyzer acquires one set of data, displays it for approximately 1 second, and then acquires another set.

NOTE

This key drives a momentary contact, alternate operation switch so press it only once to stop the acquisition. Pressing it twice returns the instrument to REPEAT state.

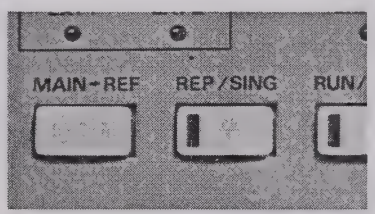


Fig. 6-6 REP/SINGLE key

6-7 Setting Change on Menus

Changes made in any of the menu input fields are registered and take effect only when the RUN/STOP key is pressed. Pressing one of the data display keys (STATE, TIMING, or MAP) restores the values currently stored in the memory, nullifying all changes made since the RUN/STOP key was last pressed.

Always alter the contents of the menus in the order MAIN before HIGH. After making any changes on the HIGH mode menu, always return to the MAIN mode menu. After making any changes on the MAIN mode menu, always double-check the trigger specifications on the HIGH mode menu. Otherwise, incompatible trigger specifications may result in an error when the RUN/STOP key is pressed.

6-8 Using external clocks

When the user specifies an external clock and then presses the RUN/STOP key, the VP-3662A ignores the first five clock pulses. See Fig. 6-7.

Pressing the RUN/STOP key resets the Logic Analyzer to its initial state. Then, it deliberately ignores the first 6 clock pulses to block accidental triggering and storage of incorrect data. It starts tracing with the seventh clock pulse.

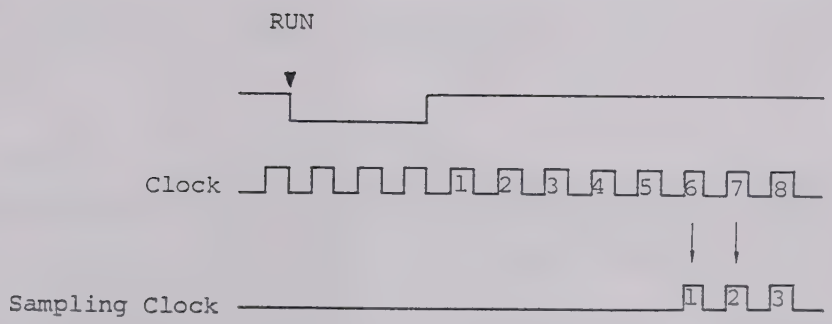


Fig. 6-7 Using an External CLock

SECTION VII
DATA DISPLAYS

7-1 BRIEF INTRODUCTION

The VP-3662A Logic Analyzer offers a choice of four formats for displaying the stored data. There are three keys located in the DISPLAY control area in the upper right-hand corner of the front panel : STATE, TIMING, and MAP display modes. There are two separate MAP modes (MAP 1 and MAP 2) available by specifying "1" or "2" on the MAP menu.

(1) STATE table display

The STATE display mode offers a choice of four data representations : binary (BIN), octal (OCT), hexadecimal (HEX), and ASCII codes. Adding optional accessories such as a GP-IB analyzer or Personality Kit (see Section VIII) offers the additional choice of mnemonic representation.

In the STATE mode, the VP-3662A can display up to 20 lines of data from up to 48 diferent channels.

(2) TIMING diagram

The TIMING display mode gives the stored data as a timing diagram. The data must have been stored using the internal clock so are therefore limited to HIGH mode data and data from Probes A and B in 16ch(1) mode.

This mode can not only display all 1001 words of the data, but also has a horizontal magnification function which permits closer inspection of timing diagram details. Vertically, the user can specify 4, 8 or 16 channels and even mix data from the MAIN and HIGH modes in the same display.

(3) MAP 1

This mode maps the 1001 stored data words onto an 8-bit (256 x 256) grid using the contents of the upper and lower bytes as coordinates. It is limited to data from Probes C and D stored in the MAIN mode. It also features a magnifying function which displays 14-bit or 12-bit data on a 7- or 6-bit grid.

(4) MAP 2

This mode plots the hexadecimal value of each byte on the vertical axis versus its time of arrival. Up to 251 words can be dispalyed at one time. Like MAP 1, it is restricted to use with data from Probes C and D stored in the MAIN mode. It is most useful for investigating the changes in data as a function of time.

Note : Pressing the MAP key recalls the MAP mode last used. To change it, alter the input field on the MAP menu. (see 7-4 (1))

7-2 STATE DISPLAY MODE

In the STATE mode, the VP-3662A displays the acquired data in a state table format up to 20 lines per screen. The available number of channels is 32 from the MAIN mode or 48 from both the MAIN and HIGH modes. The user has a choice of four notations for each group of 8 channels : binary (BIN), octal (OCT), hexadecimal (HEX), and ASCII codes. Optional accessories enable mnemonic representation for each function.

In addition to the acquired data, the display also contains such information as

* TRACE MODE
* The name of the memory containing the data displayed on the screen
* CLOCK and DELAY settings for the data acquisition
* The mark "T" for the data which caused triggering and its memory address
* C and R cursor addresses and their difference
* Data display notations
* Probe and channel numbers

The rest of this section discusses the following topics :

(1) Specifying the data to be displayed ..... 7 - 2
(2) Limits on the use of the HIGH mode display ..... 7 - 3
(3) Changing data acquisiiton conditions ..... 7 - 3
(4) 32-ch STATE display ..... 7 - 4
(5) 16-ch(1) STATE display ..... 7 - 7
(6) 16-ch(2) STATE display ..... 7 - 10
(7) Data notations ..... 7 - 12
(8) Line and page scrolling ..... 7 - 15
(9) Changing the channel sequence ..... 7 - 15
(10) Changing the polarity ..... 7 - 16
(11) Blanking irrelevant data ..... 7 - 16

(1) Specifying the data to be displayed

The STATE display mode offers a choice of four sources of data : MAIN (main memory), REF (reference memory), M/R (alternating display of data from both memories), and HIGH (simultaneous display of data from both MAIN and HIGH modes). To change the source, use the EDIT keys to position the blinking field on the STATE input field (see Fig. 7-1) and then run through the choices with the S key (21). Pressing the STATE key (2) registers the new choice and updates the display.

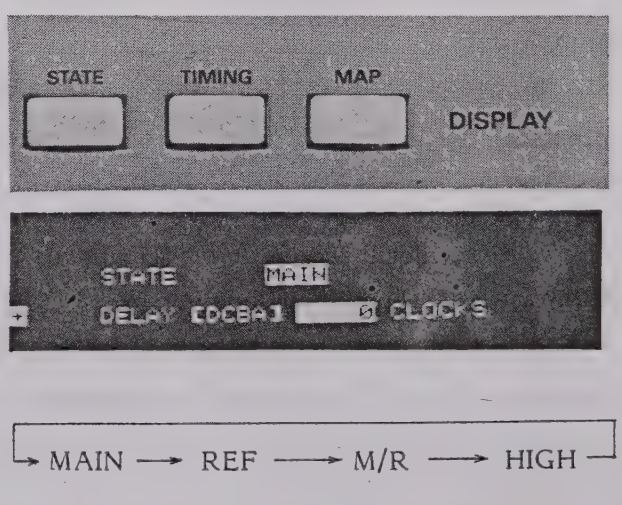


Fig. 7-1 Specifying Memory Area

(a) [MAIN]

This selection displays the 32 channels of MAIN mode data stored in the main memory area. It cannot be used to display HIGH mode data.

(b) [REF]

This selection displays the 32 channels of MAIN mode data stored in the reference memory area.

(c) [M/R]

The display alternates between the contents of the above two memory areas. To maintain the distinction, the STATE input field also alternates--between [MAIN] and [REF] to freeze the display for a closer look, press the STATE key (2).

(d) [HIGH]

The display shows all data collected in both the MAIN and HIGH modes. As screen space is limited, binary notation cannot be used for MAIN mode data. The HIGH mode data, however, can appear in any of the four available notations (binary, octal, hexadecimal, or ASCII codes).

The HIGH mode does not have a reference memory.

(2) Limits on [HIGH] selection

Although the HIGH selection displays a total of 48 channels data from both the MAIN and HIGH modes, certain MAIN mode operations are blocked :

* binary notation
* changing the channel sequence
* changing the polarity of displayed data
* displaying the contents of the reference memory area
* Blanking irrelevant

(3) [Changing data acquisition conditions]

Although the STATE display screen is primarily for displaying data which has already been stored in the VP-3662A, it contains input fields for specifying the input conditions CLOCK and DELAY. This addition makes it unnecessary to regurn to the MENU display to change these conditions for the next series of readings.

As an example, consider the 16-ch(1) display shown in Fig. 7-2. The six CLOCK and DELAY specifications can be changed over the following ranges :

(1) MAIN mode probes D and C CLOCK : [EXT1+] , [EXT1-]
(2) MAIN mode probes B and A CLOCK : INT [50 ns] [50 ms]
(3) HIGH mode CLOCK : INT [10 ns] [50 ms] or [EXT3+] , [EXT3-]
(4), (5), (6) DELAYS for the above : separately specified anywhere in the range [0] [65535]

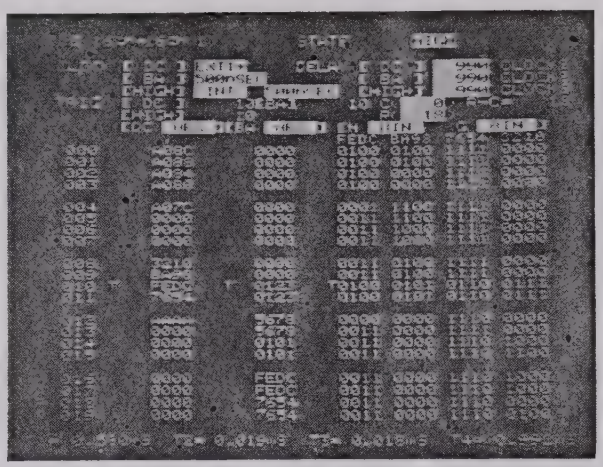


Fig. 7-2 Sample Display (16-Chanel (1) Mode)

(4) [32-Channel STATE display]

(a) MAIN mode data only

Fig. 7-3 shows a typical display of data collected in the MAIN mode. The numbers provide a cross-reference to the explanations which follow.

(1) Trace mode : 32-ch

(4) Displaying data area : [MAIN] (also available : [REF] , [M/R] , [HIGH])

(2) MAIN mode sampling clock : [EXT1+] (also avaiable : [EXT1-])

(5) Main mode delay : (can be set anywhere in the range [0] - [65535])

(3) The memory address of the data which caused triggering. If the data is not stored in the 1K-word memory area, a number will appear with a minus sign.

(6) C-CURSOR address

(7) R-CURSOR address

(8) Offset between the two cursors

(18) Notation for Probe D data : [BIN]

Also available are [OCT] , [HEX] , [ASCII] , [GP-IB] , and [D.ASM] .

Note : The last two are only available when the VP-3662P is equipped with a GP-IB Analyzer or microprocessor Personality Kit. (see Section 9 Options and Accessories) Otherwise, it loops from [ASCII] to [BIN] .

(19) Notation for Probe C data : [BIN]

Also available are [OCT] , [HEX] , and [ASCII] .

(11) Notation for Probe B data : [BIN]

Also available are [OCT] , [HEX] , [ASCII] , and [GP-IB] .

Note : GP-IB mnemonics are only available when the VP-3662P is equipped with a GP-IB Analyzer. (see Section 7 Options and Accessories) Otherwise, it loops from [ASCII] to [BIN] .

⑨ Notation for Probe A data : [BIN]
Also available are [OCT] , [HEX] , and [ASCII] .

⑰ Channel numbers and data polarity.

⑮ Data from Probe D

⑭ Data from Probe C

⑫ Data from Probe B

⑩ Data from Probe A

⑬ T : The mark to indicate the data which caused triggering

⑯ C-CURSOR

(b) Data from both MAIN and HIGH modes

Fig. 7-4 shows a typical display of data from both modes.

㉑ HIGH mode sampling clock : (available : [INT] , [EXT3+] , [EXT3-])

㉓ HIGH mode delay : (can be set anywhere in the range 0-65535)

㉛ The memory address of the data which caused HIGH mode triggering. If the data is not stored in the 1K-word memory area, a number will appear with a minus sign.

㉜ Notation for data from Probes D and C : [HEX]
Also available are [OCT] and [ASCII] .

㉒ Notation for data from Probes B and A : [HEX]
Also available are [OCT] and [ASCII] .

㉔ Notation for data from Probe H : [BIN]
Also available are [OCT] , [HEX] , and [ASCII] .

㉕ Notation for data from Probe G : [BIN]
Also available are [OCT] , [HEX] , and [ASCII] .

㉚ Data from Probes D and C

㉙ Data from Probes B and A

㉗ Data from Probe H

㉖ Data from Probe G

㉘ T : The mark to indicate the data which caused HIGH mode triggering.

⑳ Time interval displays T1-T4 (see paragraph 5-15 for details)

NOTE

When MAIN mode data share the screen with HIGH mode data, neither their channel sequence nor their polarity can be changed.

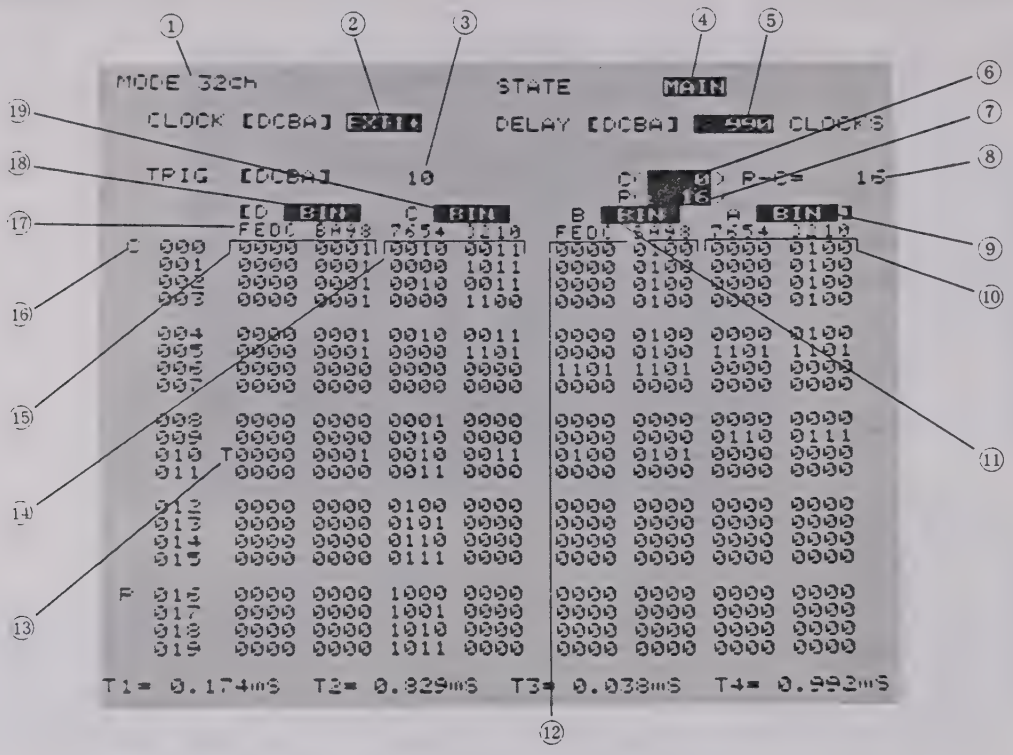


Fig. 7-3 32-ch STATE Display (MAIN Mode Data Only)

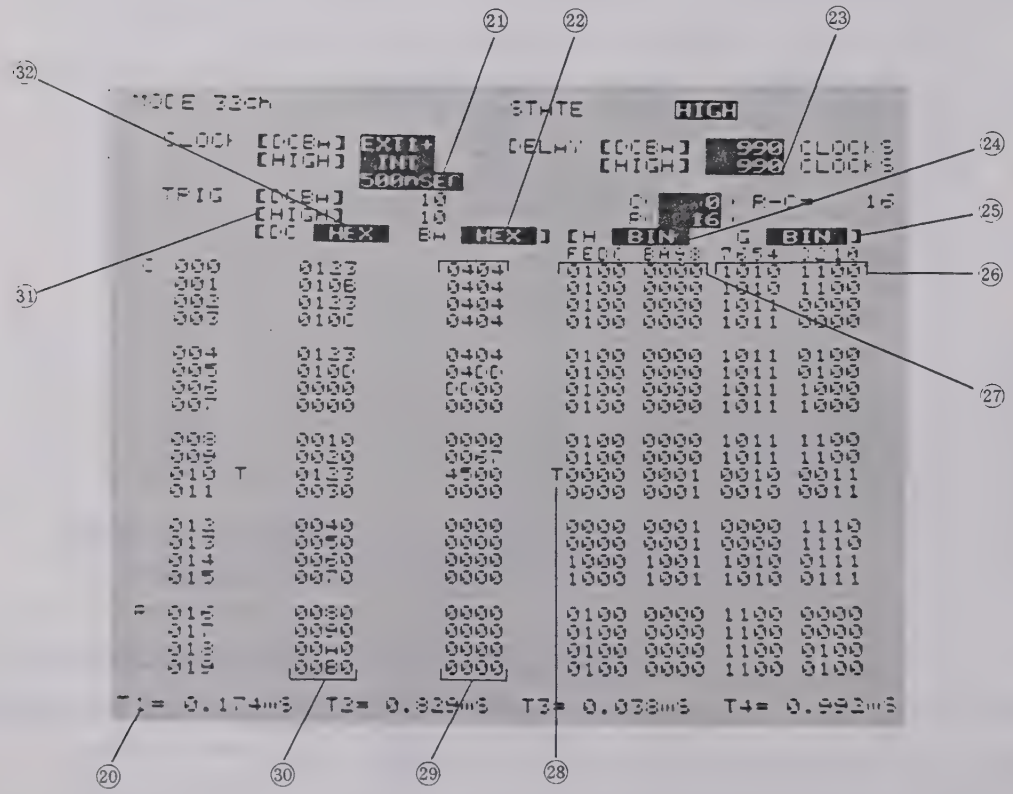


Fig. 7-4 32-ch STATE Display (Both MAIN and HIGH Mode Data)

(5) [16-ch(1) STATE display]

(a) MAIN mode data only

Fig. 7-5 shows a typical display for data collected in the MAIN mode.

(1) Trace mode : 16-ch(1)

(8) Displaying data area : [MAIN] (also available : [REF] , [M/R] , [HIGH])

(2) Sampling clock for Probes D and C : [EXT1+] (also available : [EXT1-])

(3) Sampling clock for Probes B and A :

(INT can be set anywhere in the range [50 ns] [50 ms])

(9) Delay for Probes D and C

(10) Delay for Probes B and A

(4) The memory address of the data which caused Probes D and C triggering

(5) The memory address of the data which caused Probes B and A triggering

(7) C-CURSOR address

(6) R-CURSOR address

(11) Offset between the two cursors

(24) Notation for Probe D data : [HEX]

Also available are [BIN] , [OCT] , [ASCII] , [GP-IB] , and [D.ASM] .

Note : The last two are only available when the VP-3662P is equipped with a GP-IB Analyzer or microprocessor Personality Kit. (see Section 7 Options and Accessories) Otherwise, it loops from [ASCII] to [BIN] .

(21) Notation for Probe C data : [HEX]

Also available are [BIN] , [OCT] , and [ASCII] .

(13) Notation for Probe B data : [BIN]

Also available are [OCT] , [HEX] and [ASCII] .

(12) Notation for Probe A data : [BIN]

Also available are [OCT] , [HEX] , and [ASCII] .

(23) Channel numbers and data polarity.

(16) Data from Probes D and C

(15) Data from Probe B

(14) Data from Probe A

(19) T : The mark to indicate the data which caused Probes D and C triggering.

(20) T : The mark to indicate the data which caused Probes B and A triggering.

(22) C-CURSOR

(18) R-CURSOR

(17) Time interval displays T1-T4 (see paragraph 5-15 for details)

(b) Data from both MAIN and HIGH modes

Fig. 7-6 shows a typical display of data from both modes.

㉕ HIGH mode sampling clock : [INT] (available : [EXT3+] , [EXT3-])

㉖ HIGH mode delay : (can be set anywhere in the range 0-65535)

㊱ The memory address of the data which caused HIGH mode triggering. If the data is not stored in the 1K-word memory area, a number will appear with a minus sign.

㉟ Notation for data from Probes D and C : [HEX]
Also available are [OCT] and [ASCII] .

㉞ Notation for data from Probes B and A : [HEX]
Also available are [OCT] and [ASCII] .

㉘ Notation for data from HIGH mode Probe H : [BIN]
Also available are [OCT] , [HEX] , and [ASCII] .

㉗ Notation for data from HIGH mode Probe G : [BIN]
Also available are [OCT] , [HEX] , and [ASCII] .

㉜ Data from Probes D and C

㉛ Data from Probes B and A

㉚ Data from Probe H

㉗ Data from Probe G

㉝ T : The mark to indicate the data which caused HIGH mode triggering

NOTE

When MAIN mode data share the screen with HIGH mode data, neither their channel sequence nor polarity can be changed.

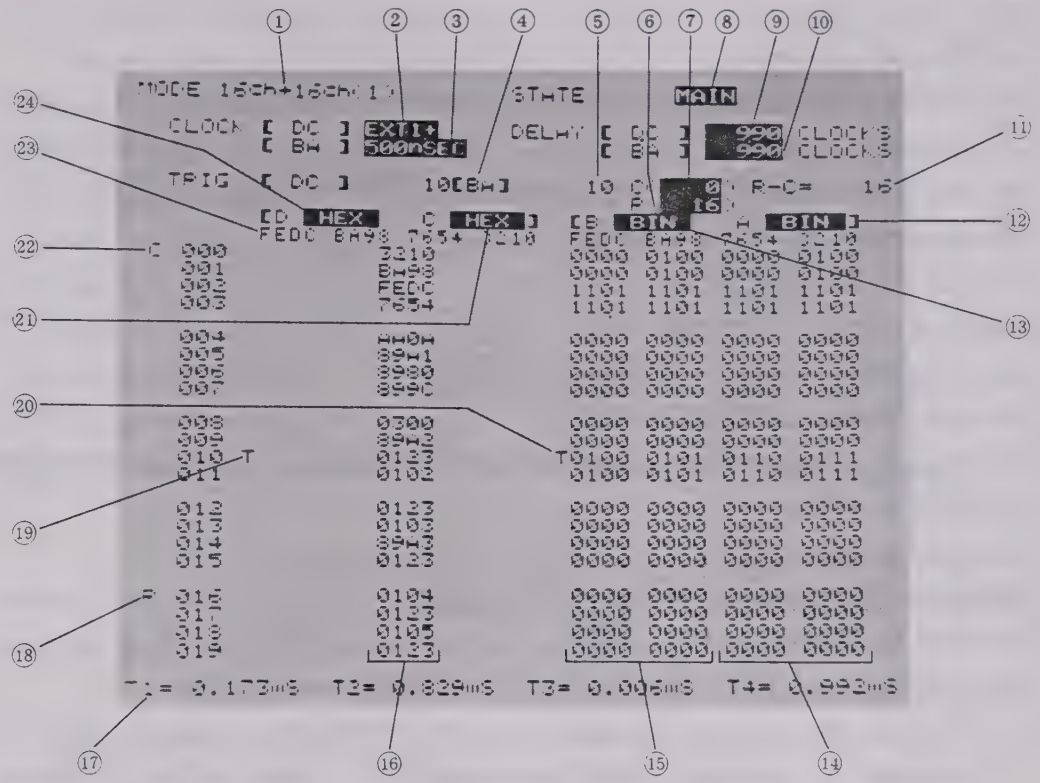


Fig. 7-5 16-ch(1) STATE Display (MAIN Mode Data Only)

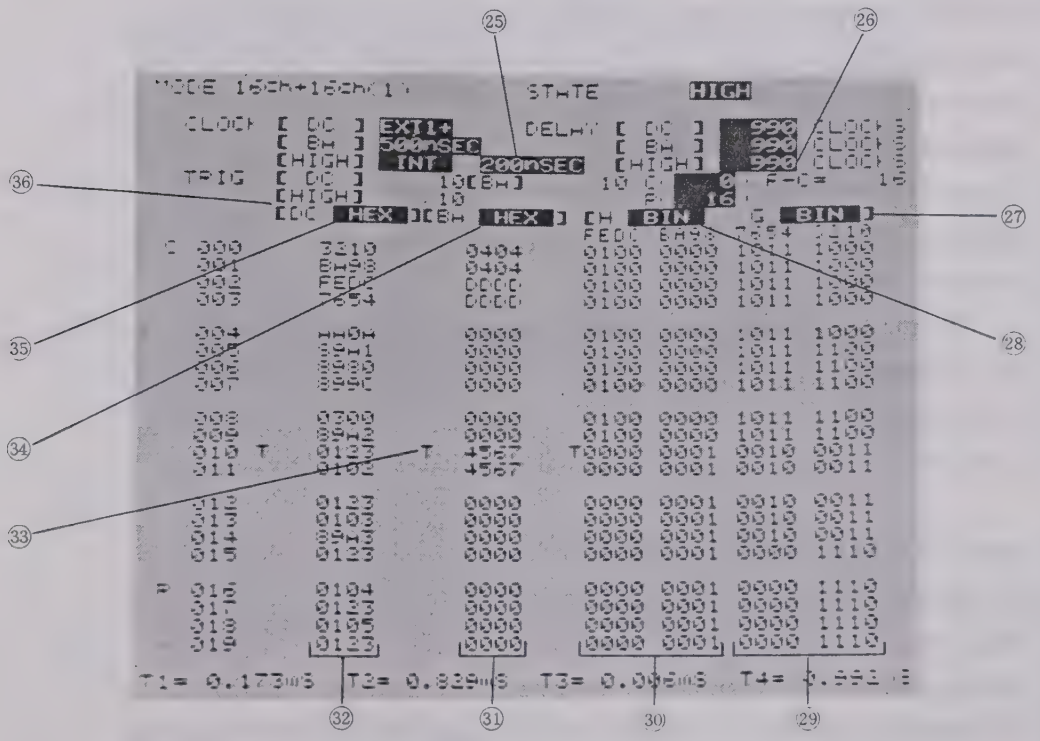


Fig. 7-6 16-ch(1) STATE Display (Both MAIN and HIGH Mode Data)

(6) [16-ch(2) STATE display]

(a) MAIN mode data only

Fig. 7-7 shows a typical display for data collected in the MAIN mode.

(1) Trace mode : 16-ch(2)

(5) Displaying data area : [MAIN] (also available : [REF] , [M/R] , [HIGH])

(2) Sampling clock for Probes D and C : [EXT1+]
(also available : [EXT1-])

(3) Sampling clock for Probes B and A : [EXT1+]
(also available : [EXT1-] , [EXT2+] , [EXT2-])

(6) Delay for Probes D, C, B, and A

(4) The memory address of the data which caused Probes D, C, B, and A triggering

(7) C-CURSOR address

(8) R-CURSOR address

(9) Offset between the two cursors

(18) Notation for Probe D data : [HEX]
Also available are [BIN] , [OCT] , [ADCII] , [GP-IB] , and [D.ASM] .

Note : The last two are only available when the VP-3662P is equipped with a GP-IB Analyzer or microprocessor Personality Kit. (see Section 9 Options and Accessories) Otherwise, it loops from [ASCII] to [BIN] .

(17) Notation for Probe C data : [HEX]
Also available are [BIN] , [OCT] , and [ASCII] .

(11) Notation for Probe B data : [HEX]
Also available are [BIN] , [OCT] , and [ASCII] .

(20) Channel numbers and data polarity.

(13) Data from Probes D and C

(12) Data from Probes B and A

(16) T : The mark to indicate the data which caused Probes D and C triggering

(19) C-CURSOR

(15) R-CURSOR

(14) Time interval displays T1-T4 (see paragraph 5-15 for details)

(b) Data from both MAIN and HIGH modes

Fig. 7-8 shows a typical display of data from both modes.

(21) HIGH mode sampling clock : (available : [INT] , [EXT3+] , [EXT3-])

(22) HIGH mode delay : (can be set anywhere in the range 0-65535)

(32) The memory address of the data which caused HIGH mode triggering.

(31) Notation for data from Probes D and C : [HEX]
Also available are [OCT] and [ASCII] .

㉚ Notation for data from Probes B and A : HEX
Also available are OCT and ASCII .

㉔ Notation for data from HIGH mode Probe H : BIN
Also available are OCT , HEX , and ASCII .

㉓ Notation for data from HIGH mode Probe G : BIN
Also available are OCT , HEX , and ASCII .

㉘ Data from Probes D and C

㉗ Data from Probes B and A

㉖ Data from Probe H

㉕ Data from Probe G

㉙ T : The mark to indicate the data which caused HIGH mode triggering

NOTE

When MAIN mode data share the screen with HIGH mode data, neither their channel sequence nor polarity can be changed.

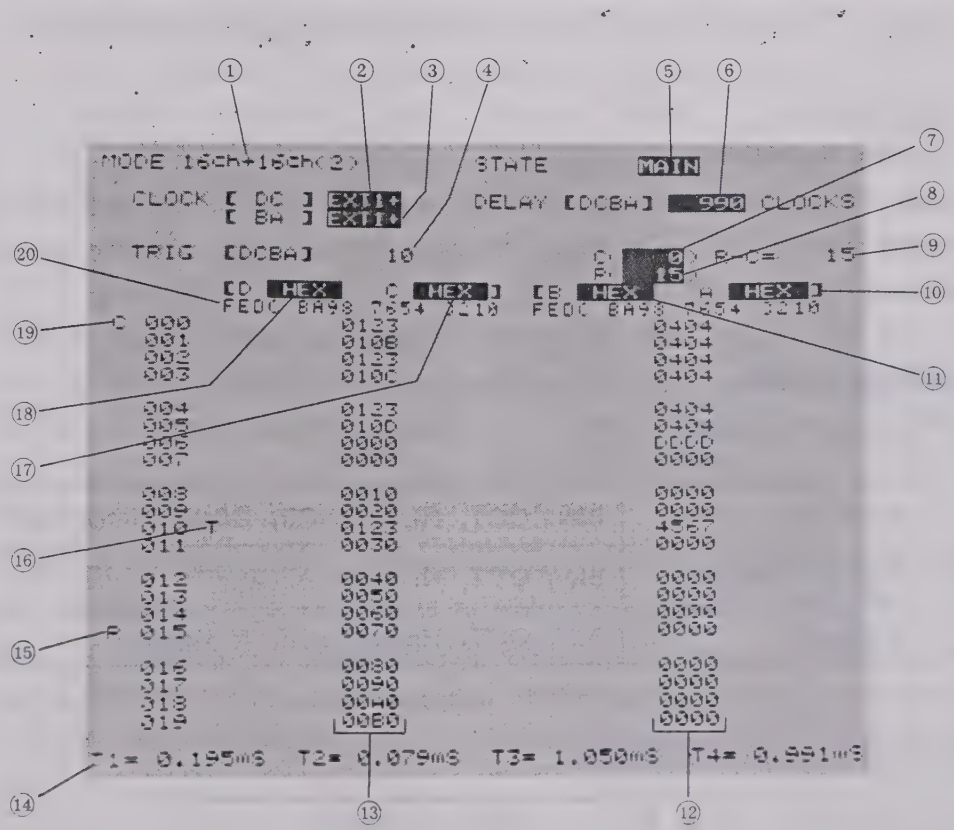

MODE 16ch+16ch(2)
STATE
MAIN
CLOCK [DC] EXTI↓
[BA] EXTI↓
DELAY [DCBA] 990 CLOCKS
TRIG [DCBA] 10
D: 0 B-C= 15
B: 15
[D HEX] C HEX] [B HEX] A HEX]
FEDC BA98 7654 3210 FEDC BA98 7654 3210
T1= 0.195mS T2= 0.079mS T3= 1.050mS T4= 0.991mS
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳

Fig. 7-7 16-ch(2) STATE Display (MAIN Mode Data Only)

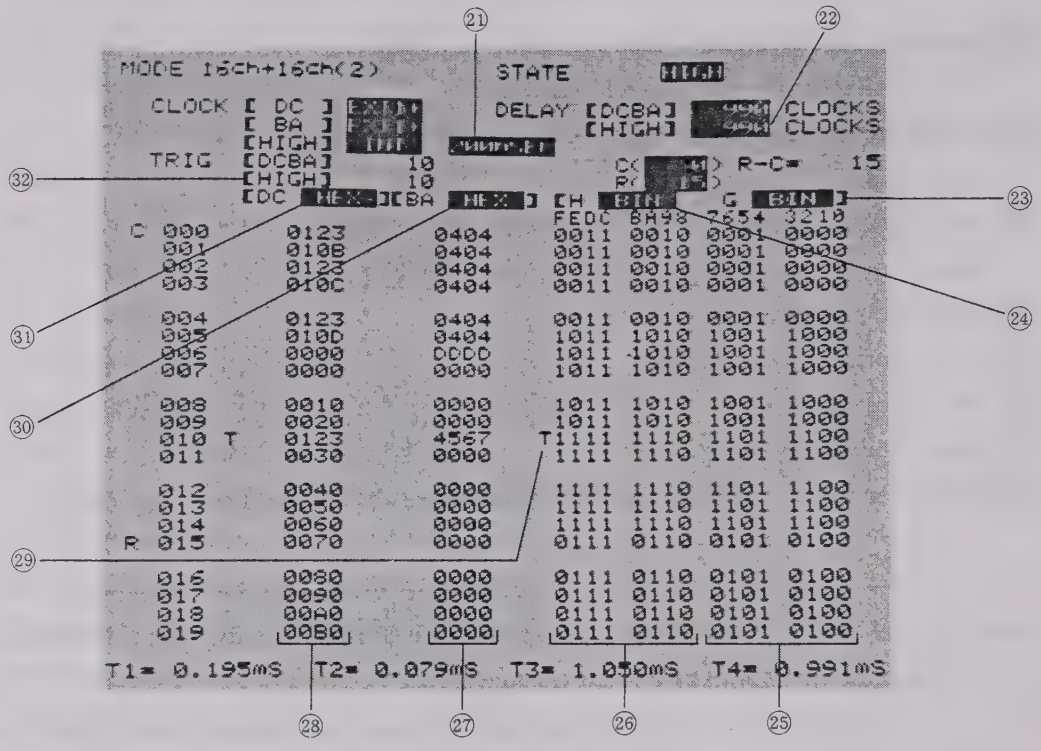


Fig. 7-8 16-ch(2) STATE Display (Both MAIN and HIGH Mode Data)

(7) Data representation

(a) Changing the notation

To change the data notation, use the EDIT keys (17) - (20) to shift the blinking to the appropriate input field and then run through the available selections with the S key (21). To register the change, press the STATE key (2).

(b) Notations available

32-ch trace mode, STATE = MAIN

Probe D	BIN, OCT, HEX, ASCII, GP-IB, & D.ASM
Probes C & A	BIN, OCT, HEX, & ASCII
Probes B	BIN, OCT, HEX, ASCII, & GP-IB

32-ch trace mode, STATE = HIGH

Probes D, C, B, & A	OCT, HEX, & ASCII
Probes H & G	BIN, OCT, HEX, & ASCII

16-ch(1) trace mode, STATE = MAIN

Probe D	BIN, OCT, HEX, ASCII, & GP-IB
Probes C, B, & A	BIN, OCT, HEX, & ASCII

16-ch(1) trace mode, STATE = HIGH

Probes D, C, B, & A	OCT, HEX & ASCII
Probes H & G	BIN, OCT, HEX, & ASCII

16-ch(2) trace mode, STATE = MAIN

Probe D	BIN, OCT, HEX, ASCII GP-IB, & D.ASM
Probes C & A	BIN, OCT, HEX, & ASCII
Probes B	BIN, OCT, HEX, ASCII & GP-IB

16-ch(2) trace mode, STATE = HIGH

Probes D, C, B, & A	OCT, HEX, & ASCII
Probes H & G	BIN, OCT, HEX, ASCII

(c) GP-IB mnemonics

The GP-IB representation translates the binary bus data into the easier to read GP-IB mnemonics. This function is only available when the VP-3662A includes the GP-IB Analyzer option. (see Section 9 Options and Accessories)

(d) D. ASM mnemonics

The D.ASM representation translates the data from the microprocesor's bus into the appropriate assembly language mnemonics to make it easier for the user to interpret the program flow. This function is only available when the VP-3662A has been fitted with the optional Personality Kit for the microprocessor at the heart of the system under test. (see Section 9 Options and Accessories) Fig. 7-10 shows such a display for an 8-bit, Zilog Z-80 system.

(e) ASCII codes

The ASCII representation translates the input data into the corresponding ASCII codes (reproduced here as Table 7-1). Note that this translation ignores the highest bit (b_8).

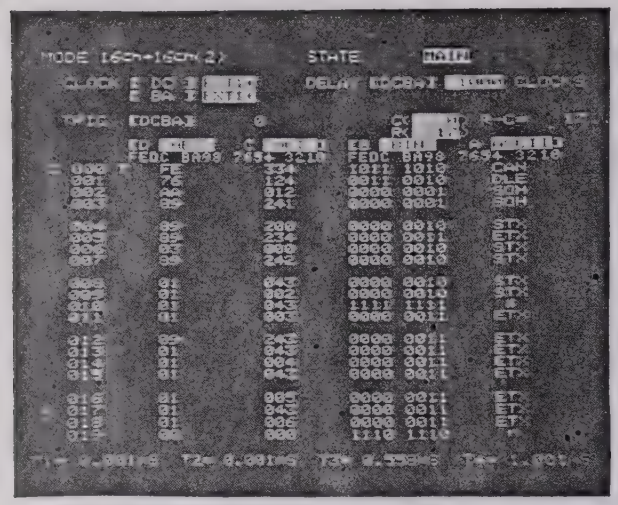


Fig. 7-9 STATE Display using ASCII Codes

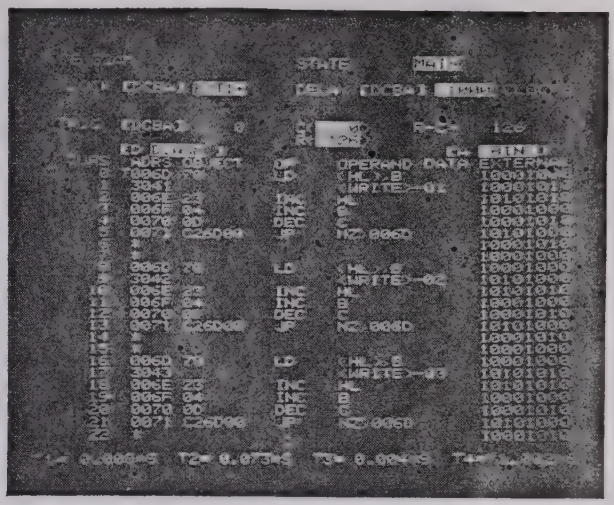


Fig. 7-10 STATE Display using D.ASM

Table 7-1 VP-3662P ASCII Codes

b_7	b_6	b_5	b_4	b_3	b_2	b_1	行 \ 列	0	1	2	3	4	5	6	7
			0	0	0	0	0	NUL	DLE		Ø	@	P	`	p
			0	0	0	1	1	SOH	DC_1	!	1	A	Q	a	q
			0	0	1	0	2	STX	DC_2	"	2	B	R	b	r
			0	0	1	1	3	ETX	DC_3	#	3	C	S	c	s
			0	1	0	0	4	EOT	DC_4	$	4	D	T	d	t
			0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
			0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
			0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
			1	0	0	0	8	BS	CAN	(	8	H	X	h	x
			1	0	0	1	9	HT	EM	)	9	I	Y	i	y
			1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
			1	0	1	1	B	VT	ESC	+	;	K	[	k	{
			1	1	0	0	C	FF	FS	,	<	L	\	l	|
			1	1	0	1	D	CR	GS	−	=	M	]	m	}
			1	1	1	0	E	SO	RS	.	>	N	^	n	~
			1	1	1	1	F	SI	US	/	?	O	−	o	⣿

(8) Scrolling by line and by page

The STATE display can only hold 20 lines of data at one time. To view data in other areas of the memory, move the C-CURSOR with the scrolling functions or by specifying a new address.

(a) Scroll up

Pressing the CURSOR key (15) once increments the C-CURSOR position by one to shift the entire data portion of the display up one line. Holding it down continuously shifts the data upwards.

(b) Scroll down

Pressing the CURSOR key (15) once decrements the C-CURSOR position by one to shift the entire data portion of the display down one line. Holding it down continuously shifts the data downward.

(c) Specifying an absolute cursor position

The C-CURSOR is always positioned at the top line of the data. The user can directly specify the memory area by simply entering the address of the first of the 20 lines to be displayed.

For example, the input field (1) in Fig. 7-11 shows that the C-CURSOR is currently at location 0, the start of the memory area.

Typing a number between 0 and 1000 and entering it with the STATE key displays the line with that number and the next 19 lines after it. Of course, since there is only room for 1000 lines in the memory area, entering a number over 981 will produce a shorter display (ending with line 1000)

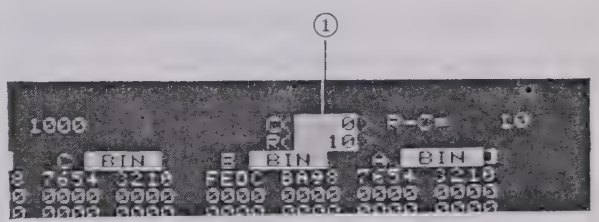


Fig. 7-11 C-CURSOR Input Field

(d) Scrolling by page

The 20 lines of data on the page constitute a "page". Faster than single line scrolling is scrolling by page which shifts the C-CURSOR 20 lines at a time. For example, if the screen currently contains lines 20-39, scrolling one page forward (with EDIT key (17)) places lines 40-59 on the screen ; scrolling one page backward (with EDIT key (19)), lines 0-19.

NOTE

Scrolling with the CURSOR or EDIT keys (15)-(19) is only possible when none of the input fields is blinking. To turn off any blinking, press the STATE key.

(9) Changing the channel sequence

The data from each probe is initially displayed in descending sequential order by channel number. This order appears just above the first line of data. The Logic Analyzer permits the user to change the order to suit the particular system being tested through the software without having to reconnect the probes themselves.

To do this, use the EDIT keys (17) - (20) to shift the blinking portion of the display to the head of the channel sequence (see (1) in Fig. 7-12) and then enter the new sequence with the hexadecimal keys 0-F.

For further details on changing the channel sequeqnce, refer to paragraph 5-12.

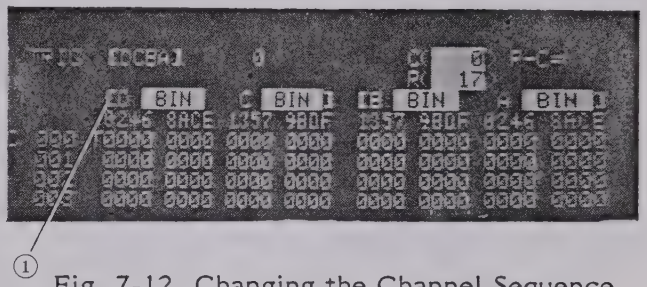


Fig. 7-12 Changing the Channel Sequence

(10) Changing the polarity

The Logic Analyzer allows the user to reverse the polarity of the data displayed when the negative logic of the input makes interpretation of the raw data extremely difficult. Changing the polarity is quite simple : first, use the EDIT keys (17) - (20) to shift the blinking portion of the display to the head of the channel sequence.

Then, press the binary key "0" 8 to reverse the polarity of the current channel (the channel number will then be displayed in reverse video). To resume the same polarity as the input, use the "1" key (7).

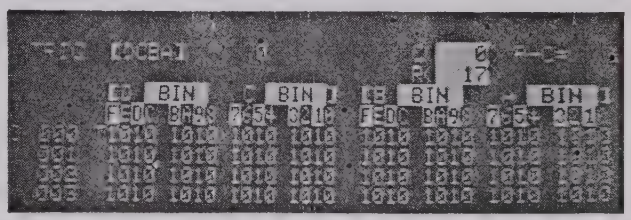


Fig. 7-13 Changing the Polarity

(11) Blanking

The VP-3662A allows the user to blank out irrelevant data from the screen to leave just the portions of interest. It uses the CURSOR keys (13) and (15) to blank undesired data--the blanking proceeds left to right--and their opposite (14) and (16) to restore data entries.

The exact method of blanking with the R- and C-CURSOR varies with the trace mode. See paragraph 5-14 for the details.

NOTE

The preceding three functions--changing the channel sequence, changing the polarity, and blanking irrelevant data--cannot be used on MAIN mode data which shares the screen with HIGH mode data.

7-3 TIMING DIAGRAM DISPLAY

This display mode displays data stored using the Logic Analyzer's internal clock. It is limited to HIGH mode data stored using the internal clock and 16-channel (1) data from Probes B and A.

In this mode, the screen can display up to 16 channels at once. Use of the vertical magnification function, however, cuts this down to eight or four. Similarly, the full display puts 1001 bits of data per channel on the screen, but this is cut down to 251, 126, or 51 bits by the horizontal magnification function.

In addition to the data itself, the screen also contains the following information

* trace mode
* horizontal and vertical magnification factors
* displaying data area (MAIN/HIGH)
* sampling clock
* delay setting
* C- and R-CURSOR values, their difference, and its time equivalent
* contents of the trigger word

This section describes the contents of this display and the operations connected therewith under the following headings :

(1) Display of HIGH mode data alone ..... 7 - 17
(2) Simultaneous display of both MAIN and HIGH mode data ..... 7 - 19
(3) Changing the data acquisition conditions ..... 7 - 24
(4) Use of the cursors ..... 7 - 24
(5) Scrolling by page ..... 7 - 25
(6) Horizontal magnification ..... 7 - 25
(7) Vertical magnification ..... 7 - 25
(8) Changing the channel sequence ..... 7 - 26
(9) Changing the polarity ..... 7 - 27
(10) Blanking irrelevant data ..... 7 - 27

(1) Display of HIGH mode data alone

When the Logic Analyzer has acquired data in the 32-channel mode, the TIMING display is limited to the 16 channels of HIGH mode data. Fig. 7-14 shows one such display.

(1) Trace mode : 32-channel
(6) Displaying data area : HIGH
(7) Horizontal magnificaiton factor : [H x 1]
(also available : [H x 4] , [H x 8] , [H x 20])

⑧ Vertical magnification factor : [V x 1]
(also availableg : [V x 2] , [V x 4])

② Sampling clock :
(can be set anywhere in the range [10 ns] - [50 ms])

⑤ Clock delay setting :
(can be set anywhere in the range [0] - [65535])

③ Channel sequence for lower half of data on the screen

⑨ Channel sequence for upper half of data on the screen

④ Addresses of data matching the trigger word set for HIGH mode trigger level 2

Note : There are two addresses : the first for the lower half channels on the screen, the second for the upper half. Since in the 32-channel mode both halves acquire data with the same delay, these addresses are the same.

⑫ C-CURSOR address

⑬ R-CURSOR address

⑩ Difference between the two cursor addresses

⑪ Cursor difference expressed as a time value

⑯ Data of each channel in the order of channel sequence specified on this display at the HIGH mode triggeing point

⑮ Binary representation of the data sotred at the location given by C-CURSOR

⑭ Binary representation of the data sotred at the location given by R-CURSOR

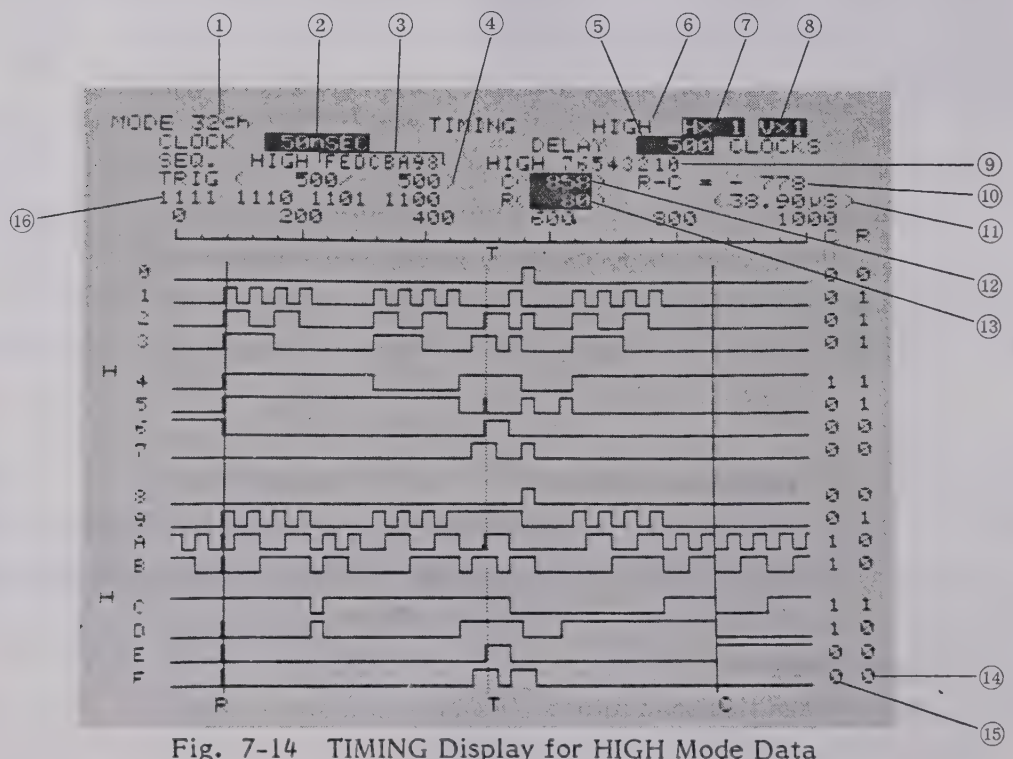


Fig. 7-14 TIMING Display for HIGH Mode Data

(2) Simultaeous display of both MAIN and HIGH mode data

For the 16-ch(1) trace mode, both the data from probes B and A and the HIGH mode data acquired with different internal clocks are available for a TIMING display either separately or together. The only difficulty with simultaneous display is that the Logic Analyzer does not permit simultaneous display of the two different sets of acquisition condisions so the user must specify which one is to be displayed. This is accomplished by setting the input field (⑥ in Fig. 7-15) to MAIN or HIGH as desired.

(a) Case I : MAIN , MAIN mode data from Probes B and A only.

Set both input fields (⑤ and ㉑ in Fig. 7-15) to MAIN (also available are REF and HIGH). The input fields ⑤ and ㉑ specify the sources of the upper and lower halves of the data, respectively.

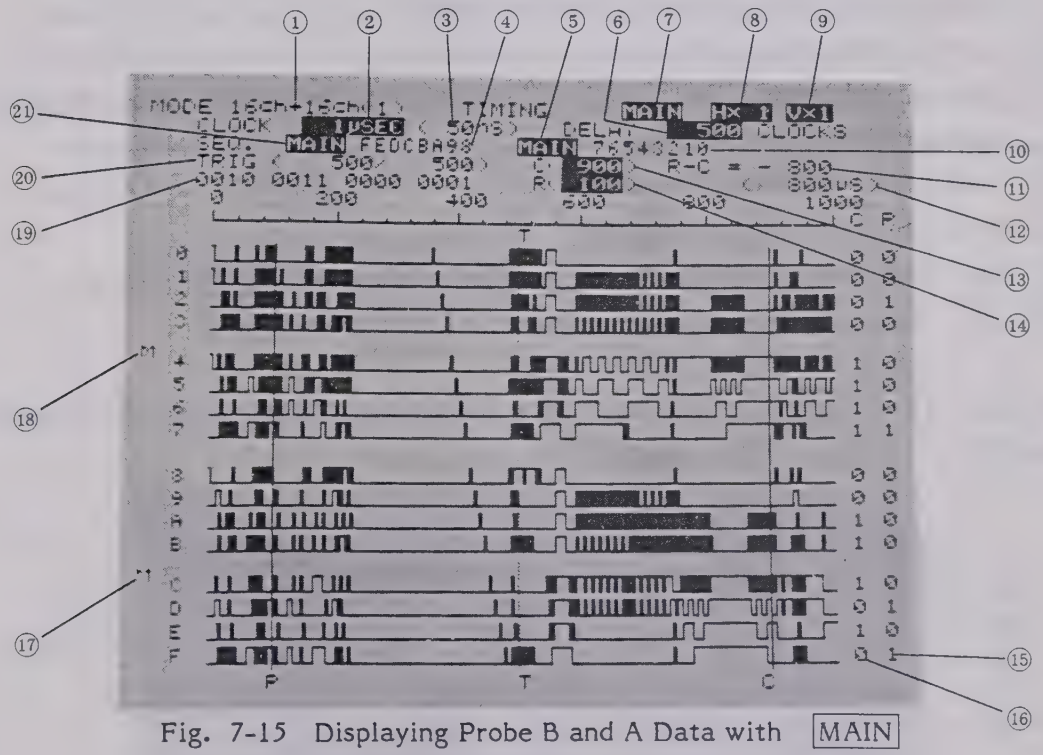


Fig. 7-15 Displaying Probe B and A Data with MAIN

① Trace mode : 16-ch(1)

⑦ Data acquisitions display : MAIN

⑧ Horizontal magnification ratio : H x 1
(also available : H x 4 , H x 8 , H x 20)

⑨ Vertical magnification ratio : V x 1
(also available : V x 2, V x 4)

② Sampling clock for Probes B and A :
(may be set anywhere in the range 50 ns - 50 ms)

③ Sampling clock

⑥ Delay for Probes B and A
(may be set anywhere in the range [0] - [65535])

④ Channel sequence for lower half of display

⑩ Channel sequence for upper half of display

⑳ Addresses of Probe B and A data matching the trigger word set for trigger level 4

Note : Since the upper and lower halves of the channels acquire data with the same delay, these addresses are the same.

⑬ C-CURSOR address

⑭ R-CURSOR address

⑪ Difference between the two cursor addresses

⑫ Cursor difference expressed as a time value

⑲ Data of each channel in the order of channel sequence specified on this display at the Probe B and A trigger point

⑯ Contents of C-CURSOR location

⑮ Contents of R-CURSOR location

⑤ ⑱ Source of data channels in upper half of display : [MAIN]

㉑ ⑰ Source of data channels in lower half of display : [MAIN]

(b) Case II : [MAIN] , simultaneous display of Probe B and A data with HIGH mode data (② = [MAIN] , ⑥ = [HIGH])

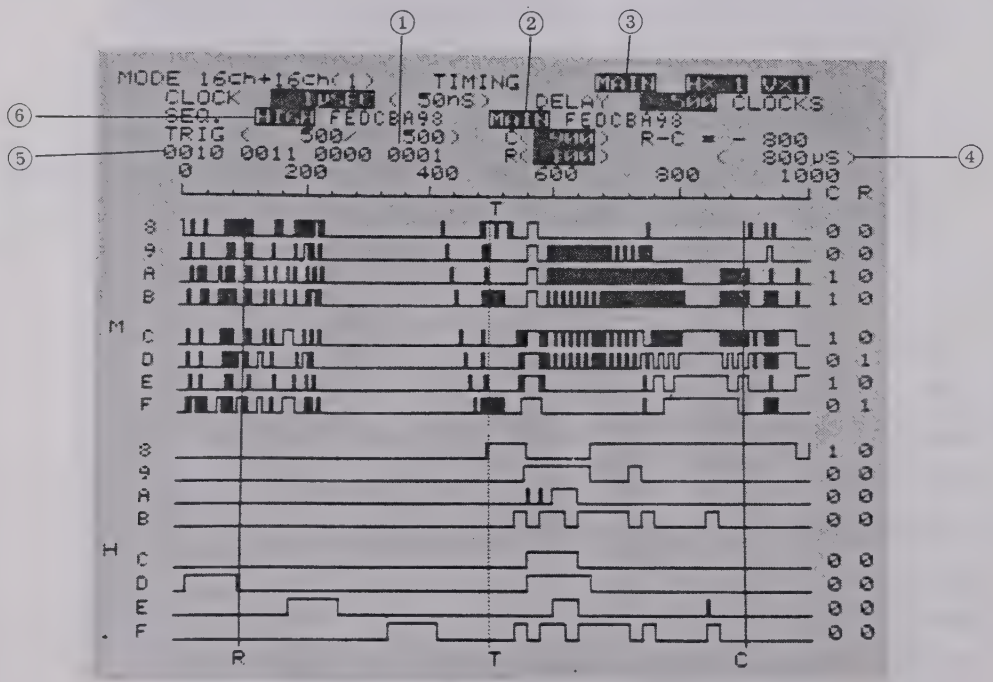


Fig. 7-16 Mixed Data with [MAIN]

We will limit our discussion to the differences from the preceding Fig. 7-15.

(3) Data acquisition conditions display

(2) Channel sequence for upper half of display : Probes B and A channels F-8

(6) Channel sequence for lower half of display : HIGH mode channels F-8

(1) Memory addresses of the data which cuased triggering in the lower and upper halves of the display. (In Fig. 7-16, these come from the HIGH mode data and the Probe B and A data, respectively.)

(4) Cursor difference expressed as a time value. In this case, it is measured in terms of the sampling interval for Probes B and A, so time measurements cannot be taken for the HIGH mode data. For Fig. 7-16, only the time for the upper half of the display can be measured. This is different from a display of HIGH mode data alone where all times are measured in terms of the HIGH mode sampling interval.

(5) The first 8 bits show the data of each channel at the triggering point in the lower half channels of the display (HIGH mode data) ; the latter 8 bits, the upper half (Probes B and A). Both 8 bits are arranged in the order of channel sequence specified on this display.

(c) Case III : HIGH Display of HIGH mode data only

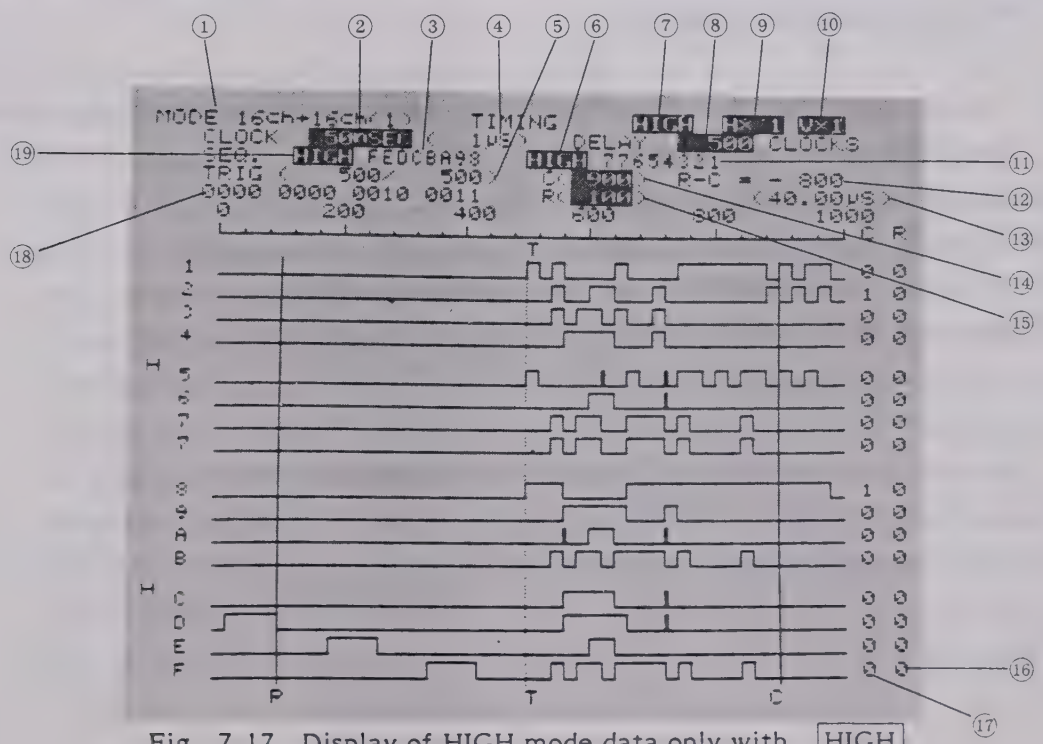


Fig. 7-17 Display of HIGH mode data only with HIGH

(1) Trace mode : 16-ch(1)
(7) Data acquisition conditions display : [HIGH]
(9) Horizontal magnification ratio : [H x 1]
(also available : [H x 4] , [H x 8] , [H x 20])
(10) Vertical magnification ratio : [V x 1]
(also available : [V x 2] , [V x 4])
(2) Sampling clock for HIGH mode
(may be set anywhere in the range [10 ns] - [50 ms])
(4) Sampling clock for Probes B and A :
(8) Delay for HIGH mode :
(may be set anywhere in the range [0] - [65535])
(3) Channel sequence for lower half of display : HIGH mode, channels F-8
(11) Channel sequence for upper half of display : HIGH mode, channels F-8
(20) Address of the data which caused HIGH mode triggering
(14) C-CURSOR address
(15) R-CURSOR address
(12) Difference between the two cursor addresses
(13) Cursor difference expressed as a time value

Note : Since only HIGH mode appears on the screen, this time is measured in terms of the HIGH mode sampling interval.

(18) Data of each channel in the order of channel sequence specified on this display at the HIGH mode triggering point
(17) Contents of C-CURSOR location
(16) Contents of R-CURSOR location
(6) Source of data channels in upper half of display : HIGH
(19) Source of data channels in lower half of display : HIGH

(d) Case IV : HIGH Simultaneous display of Probe B and A data with HIGH mode data (② = HIGH , ⑥ = MAIN)

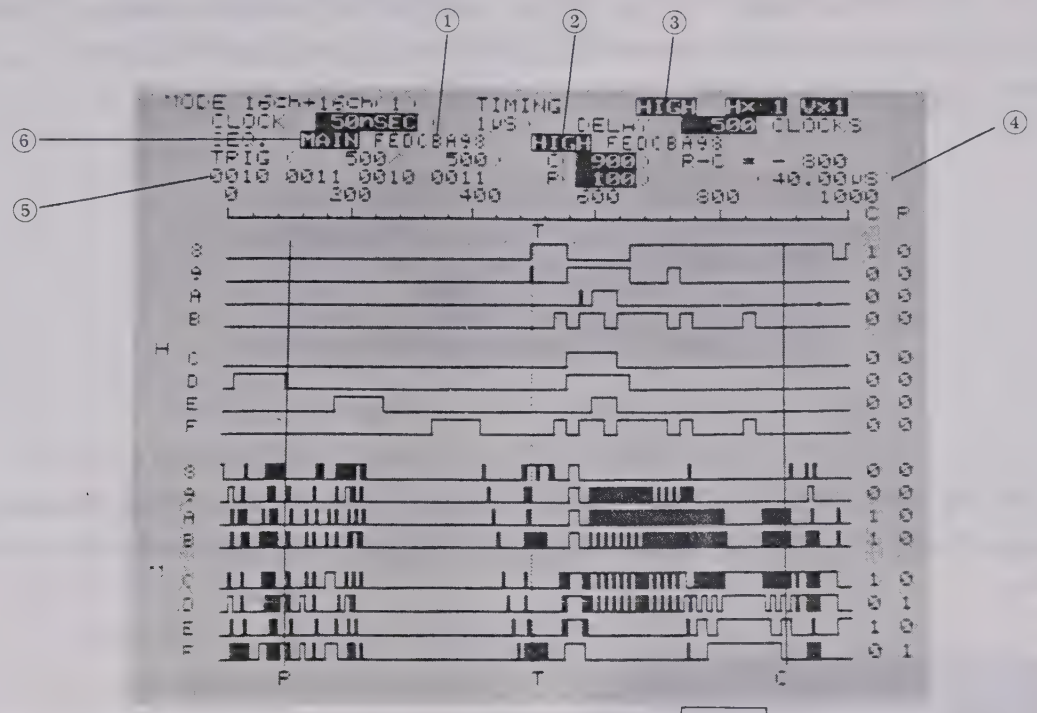


Fig. 7-18 Mixed Data with HIGH

We will limit our discussion to the differences from the display shown in the preceding Fig. 7-17.

③ Data acquisition conditions display : HIGH

② Channel sequence for upper half of display : HIGH mode, channels F-8

⑥ Channel sequence for lower half of display : Probes B and A, channels F-8

① Memory addresses of the data which caused triggering in the lower and upper halves of the display. (In Fig. 7-18, these come from the HIGH mode data and the Probe B and A data, respectively.)

④ Cursor difference expressed as a time value. In this case, it is measured in terms of the sampling interval for HIGH mode, so time measurements cannot be taken for the data from Probes B and A. For Fig. 7-18, only the time for the upper half of the display can be measured. This is different from a display of ProbeB and A data alone where all times are measured in terms of Probe B and A sampling interval.

⑤ The first 8 bits show the data of each channel at the triggering point in the lower half of the display (Probe B and A data); the latter 8 bits, the upper half (HIGH mode). Both 8 bits are arranged in the order of channel sequence specified on this display.

(3) Changing the acquisition conditions

As was the case with the STATE display, the CLOCK and DELAY specifications can be changed on the TIMING display without having to switch to the MENU display. The input field (2) in Fig. 7-19 currently contains MAIN so changing the CLOCK (1) and DELAY (3) input fields alters the data acquisition parameters for Probes B and A.

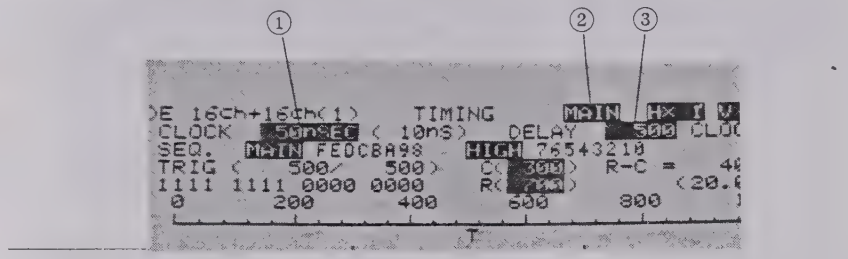


Fig. 7-19 Changing the Data Acquisition Parameters

If, on the other hand, the input field (2) in Fig. 7-19 contains HIGH, changing the CLOCK (1) and DELAY (3) input fields alters the data acquisition parameters for the HIGH mode data.

(4) Using the cursors

The TIMING displays use the R- and C-CURSOR to measure the time between events. There is, however, a restriction : the time cannot be measured in differnt halves of a 16-ch(1) display when the display contains data from both Probes B and A and the HIGH mode. The input field (2) in Fig. 7-19 determines what measurements can be taken.

(a) When MAIN was selected

Measurements use the MAIN mode sampling clock when the display contains only MAIN mode data or MAIN data mixed with HIGH mode data. If the display contains only HIGH mode data, however, the VP-3662A automatically switches to the HIGH mode sampling clock.

(b) When HIGH was selected

Measurements use the HIGH mode sampling clock when the display contains only HIGH mode data or HIGH data mixed with MAIN mode data. If the display contains only MAIN mode data, however, the VP-3662A automatically switches to the MAIN mode sampling clock.

Press the C-CURSOR control keys (15), (16) and the R-CURSOR control keys (13), (14) to shift the cursor position.

(5) Scrolloing by page

For horizontal magnification factors of 4, 8, and 20, the screen cannot display the entire 1001 columns of data at once so the Logic Analyzer divides them into pages, the size of which depends on the magnification. Use the EDIT keys (17) and (19) to horizontally scroll between pages. Pressing key (17) displays the next page ; pressing key (19), the previous one.

Horizontal Magnification Factor	Page size (columns)
H x 1	1001 (all data)
H x 4	251
H x 8	126
H x 20	51

(6) Magnifying the horizontal axis

The TIMING display usually contains all 1001 columns of data. The horizontal magnification function permits the user to magnify the display to get a closer look at 251-, 126-, or 51-column segments.

To change the magnification factor, use the EDIT keys to alter the contents of the input field ((1) in Fig. 7-20) and then press the TIMING key (3) to register the change.

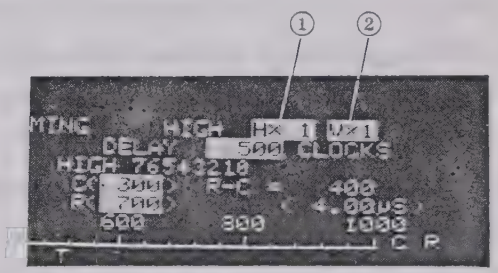


Fig. 7-20 Magnification Input Fields

NOTE

When the C-CURSOR has a value between "0" and the number given in the preceding table, the leftmost column of the display is always column "0".

(7) Magnifying the vertical axis

Similar to the horizontal magnification function is the vertical magnification function which magnifies the amplitudes of the traces on the screen. The trade-off is, however, that it also reduces the number of traces that can appear on the screen at any given time.

To change the magnification factor, use the EDIT keys to alter the contents of the input field ((2) in Fig. 7-20) and then press the TIMING key (3) to register the change.

V x 2	DOUBLE amplitudes for EIGHT channels
V x 4	QUADRUPLE amplitudes for FOUR channels

NOTE

This function preserves the split-screen nature of the display : the upper half always starts with channels 1 and 2 of the full display ; the lower half with channels 9 and 10. The intermediate case (V x 2) adds channels 3, 4, 11, and 12 to these.

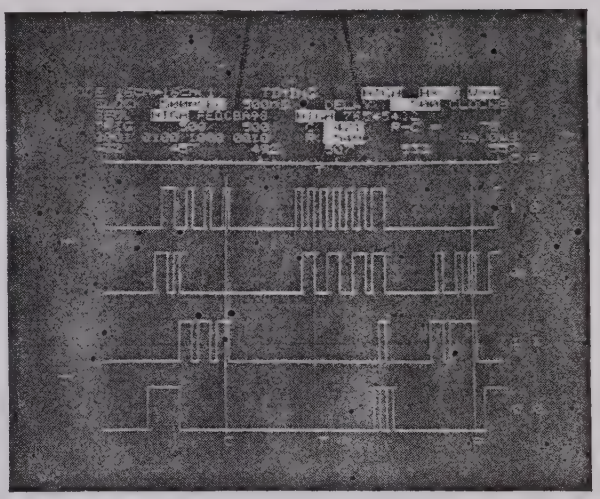


Fig. 7-21 Vertical Magnification (V x 4)

(8) Changing the Channel Sequence

Changing the channel sequence is simply a matter of changing the numbers appearing in the fields (1) and (2) of Fig. 7-22. These fields specify the channel sequences for the lower and upper halves of the (16-bit) data word. To change the contents of one of these fields, use the EDIT keys (17) - (20) to shift the blinking portion of the display to the field, type the new sequence with the hexadecimal keys, and register the change by pressing the TIMING KEY.

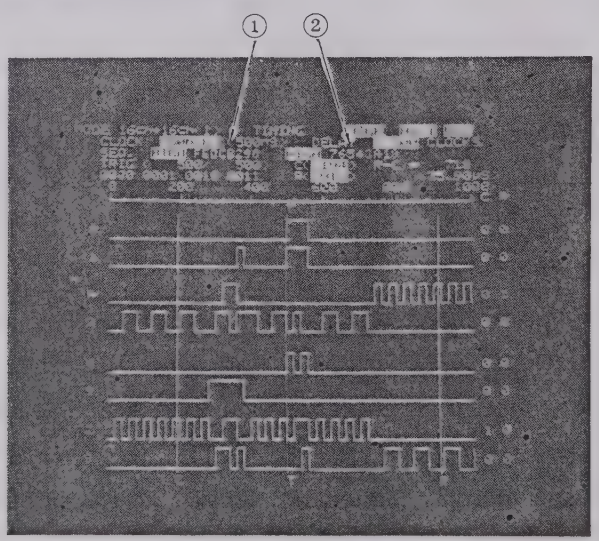


Fig. 7-22 Changing the Channel Sequence

(9) Changing the Polarity

Changing the polarity of a channel merely involves reversing the video display (from normal to reverse video) for the corresponding sequence number in the fields (1) and (2) of Fig. 7-22. To change the polarity of a channel, use the EDIT keys (17) - (20) to shift the blinking portion of the display to the field containing the channel number, use the CURSOR keys (15), (16) to blink the channel number, press the binary key (8) "0" for normal or "1" for inverse, and register the change by pressing the TIMING KEY. The reverse video remains to clearly indicate to the user that the data for that channel has been reversed for display.

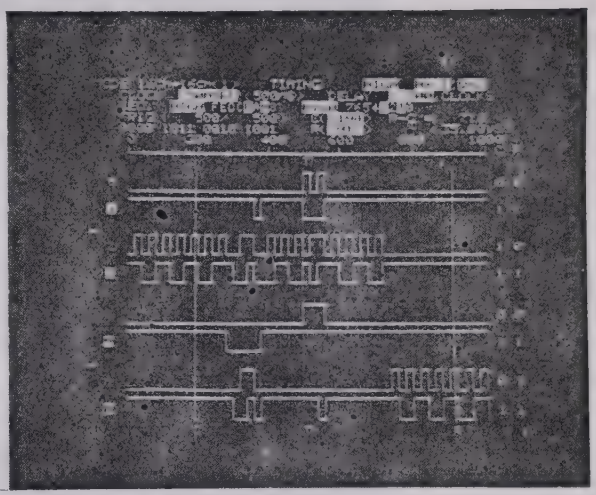


Fig. 7-23 Changing the Polarity

(10) Blanking irrelevant data

The BLANK key (12) is used to suppress the display of unwanted data channels. When the light in this key is on, pressing the CURSOR key (15) or (13) suppresses the lower most channel of the upper or lower half of the display, respectively. Pressing the reverse CURSOR key--(16) or (14), respectively-- restores the suppressed data to the screen.

7-4 MAP 1 DISPLAY

The VP-3662A offers the MAP 1 type of display for the MAIN mode data from Probes D and C. This display maps each of the 1001 words of 16-channel data onto a 256 dot square matrix. In addition to the data points and the axes, the display contains

* trace mode
* memory area in which the data is stored
* data acquisition conditions (CLOCK and DELAY)
* data which caused triggering and its address
* memory addresses for R- and C-CURSORs
* difference between the two cursor addresses
* channel sequence

The rest of this section discusses the MAP 1 display under the following headings :

(1) Specifying the MAP 1 display 7-28
(2) Description of the MAP 1 display 7-28
(3) Specifying the data to be displayed 7-30
(4) Changing the data acquisition conditions 7-30
(5) Changing the channel sequence 7-30
(6) Changing the polarity 7-30
(7) Shifting the C-CURSOR 7-31
(8) Shifting the R-CURSOR 7-31
(9) Magnifying the display 7-31

(1) Specifying the MAP 1

Pressing the MAP key (4) brings one of two map displays onto the screen. If the input field marked (1) in Fig. 7-24 contains MAP 2, use the EDIT key (18) to blink the input field, change to MAP 1 with the EDIT S key (21), and register the change by pressing the MAP key (4) a second time.

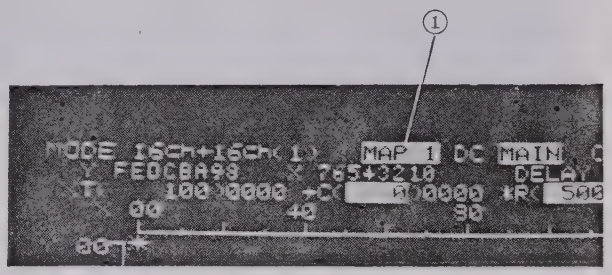


Fig. 7-24 Specifying the MAP 1 display

(2) Description of the MAP 1 display

The MAP 1 type of display maps each of the 1001 data words onto a point on a 256 dot square grid. Its primary application is displaying address transitions on a microprocessor's address bus.

Fig. 7-25 shows the axes used for this display. Since they both run 00H-FFH (in other words, 256 dots each), we can express any 16 bits data value as a single point if we use the contents of the upper bits as the Y-coordinate and those of the lower one as the X-coordinate. The sources of these two data bits are specified in the channel sequences, the input fields 1 (upper) and 2 (lower) in Fig. 7-25, where channels F-8 come from Probe D and channels 7-0, from Probe C.

For example, consider the 256 words from probes D and C shown in Table 7-2. If we plot the data from probe C as the X-coodinate, we get a steadily increasing sequence from 00H to FFH. The Y-coordinate, the data from Probe D, remains constant at 80H. When this data is displayed with MAP 1, the result is the straight line shown in Fig. 7-26.

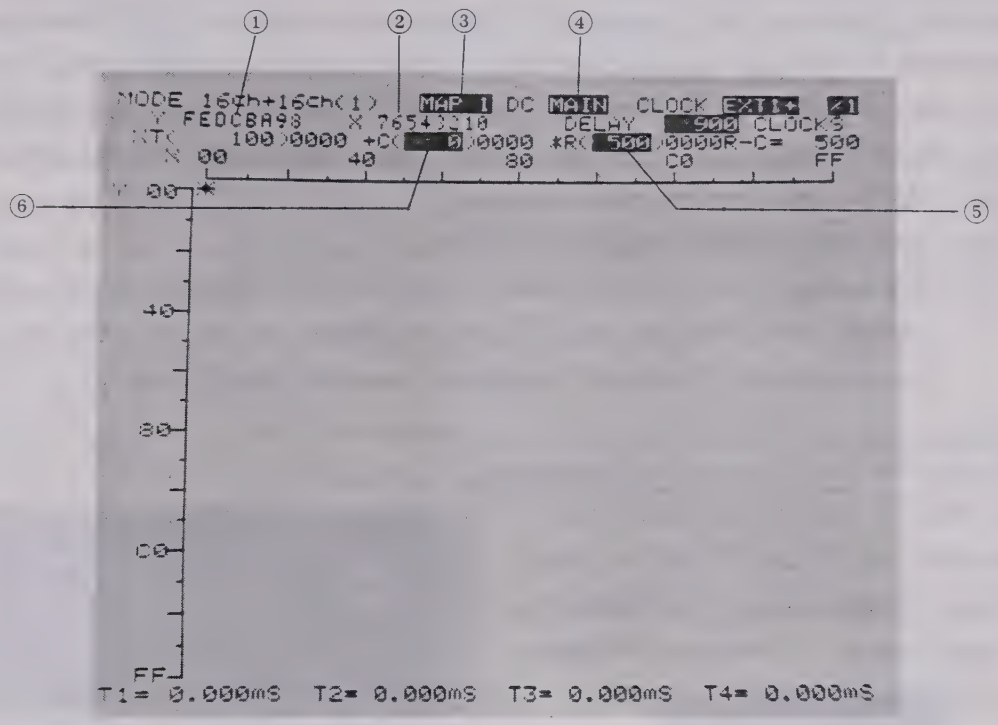


Fig. 7-25 The MAP 1 Display

Table 7-2 Sample Data

	[D]		[C]	
ADRS	FEDC	BA98	7654	3210
000	8	0	0	0
001	8	0	0	1
002	8	0	0	2
003	8	0	0	3
⋮	⋮	⋮	⋮	⋮
255	8	0	F	F

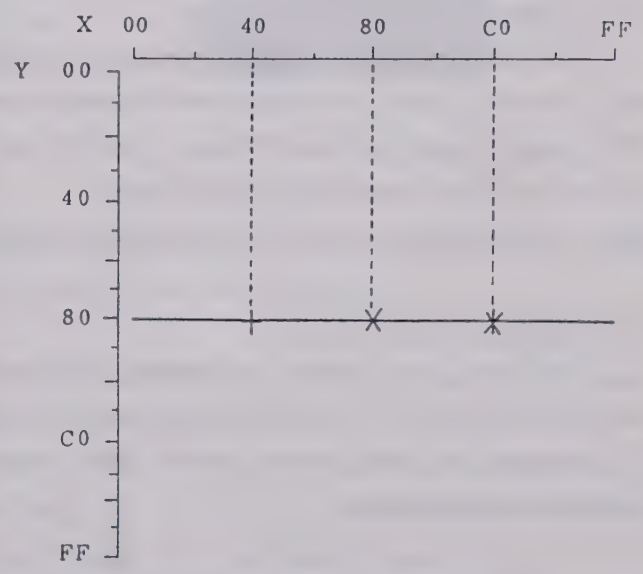


Fig. 7-26 The Same Data Displayed with MAP 1

+ = C-CURSOR (8040H)

x = Trigger (8080H)

* = R-CURSOR (8000H)

(3) Specifying the source of the data

The MAP 1 display offers a selection of three sources of data : MAIN (Main memory), REF (Reference memory), and M/R (alternation between main and reference), To change the source, use the EDIT keys to start the input field (4) blinking, press the S key (21) until the desired source appears in the input field, and register the change with the MAP key (4).

(a) MAIN--data from the main memory

(b) REF--data from the reference memory

(c) M/R--data from the main memory alternates with that from the reference memory while the input field (4) also alternates to indicate which data area is being displayed. To freeze the display, press the MAP (4) key.

(4) Changing the Data Acquisition Conditions

The MAP 1 display includes input fields labeled CLOCK and DELAY so that the user can change these two parameters for the next series of readings without having to go back to the MENU display.

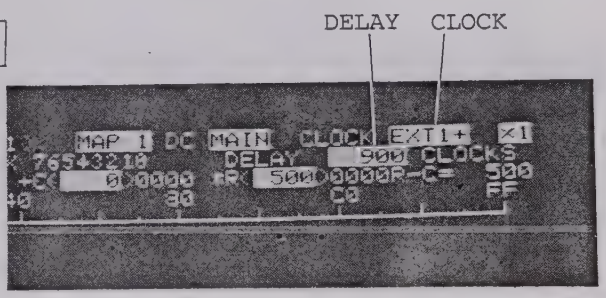


Fig. 7-27 CLOCK and DELAY Input Fields

(5) Changing the channel sequence

The display uses the channel sequence appearing in the second line of the display ((1) and (2) in Fig. 7-25). To change the channel sequence in either of these two fields, use the EDIT keys to start the field blinking, type the new sequence with the hexadecimal keys (5), and register the change with the MAP key.

Note : These fields use 8-F for the Probe D channels and 0-7 for Probe C.

(6) Changing the polarity

The user can reverse the polarity of any channel being displayed by starting the corresponding field ((1) or (2)) blinking and then specifying "0" (key (8)= reverse) or "1" (key (7) = normal) for each channel in the field. Channels reversed in this way will have their numbers in reverse video.

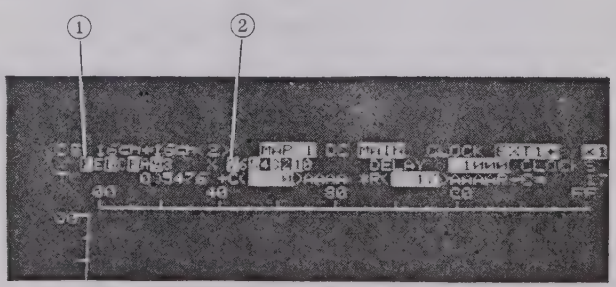


Fig. 7-28 Changing the Polarity

(7) Shifting the C-CURSOR

The MAP 1 uses a plus sign to indicate the location of the C-CURSOR. This cursor can be shifted in two different ways :

(a) one data word at a time

The cursor key (15) shifts the C-CURSOR to the right ; key (16) shifts it to the left.

(b) by specifying a new location

Enter the new location (in decimal) in the input field ((6) in Fig. 7-25) and register the change with the MAP key.

(8) Shifting the R-CURSOR

The R-CURSOR is similar to shifting the C-CURSOR : use the cursor keys ((13) and (14)) or enter a new location in the appropriate input field ((5) in Fig. 7-25).

(9) Magnifying the display

The description in (2) above dealt with 16-bit data. Using the same procedure with 14- or 12-bit data would result in a display that only used 1/4 or 1/16 of the available screen space. The VP-3662A, therefore, allows the user to expand the linear scale by a factor of 2 (for 14-bit data) or 4 (for 12-bit data) by using the EDIT S key (21) to alter the blinking input field (see Fig. 7-29) and then registering the change with the MAP key.

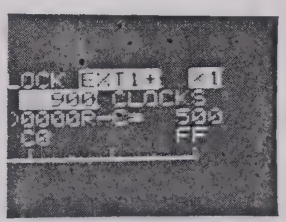


Fig. 7-29 MAP 1 Magnification Field

(a) x 2--designed for displaying 14-bit data, this factor plots the upper 7 bits versus the lower on 128 dot square grid. The axes run from 00H to 7FH.

(b) x 4--designed for displaying 12-bit data, this factor plots the upper 6 bits versus the lower on 64 dot square grid. The axes run from 00H to 3FH.

NOTE

To provide a correct evaluation of the data, the MAP display requires that Probes D and C be attached to the upper and lower halves of the addreess, respectively.

7-5 MAP 2 DISPLAY

The MAP 2 display is limited to 251 words of data from Probes D and C starting at the memory address specified by the user. In all other respects, it is the same as the MAP 1 display.

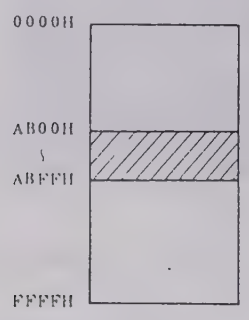
(1) Description

The MAP 2 display plots the size of the contents versus the data word's memory address, yielding a single dot for each of the 251 words being plotted. Since plotting by memory address is the same as plotting by order of acquisition, MAP 2 displays the change in data as a function of time. As with MAP 1, MAP 2's primary use is in tracing the activity on a microprocessors address bus.

The 16-bit data from Probes D and C can have a value anywhere betweenn 0000H and FFFFH (256 x 256 different possibilities), a range much greater than the 256 dots offered by the Logic Analyzer's screen. The user must therefore specify an offset, the leftmost byte of the value, by entering it in the field left of the FF on the display's vertical axis.

Example

A microprocessor executes a sequence of instructions stored in memory locations AB00H ghrough ABFFH. A VP-3662A Logic Analyzer connected to the microprocesor's address bus stores readings in its memory locations 00-FFH. To display this data, we specify an offset address of ABH and obtain the display shown in Fig. 7-30.



Memory map for system under test

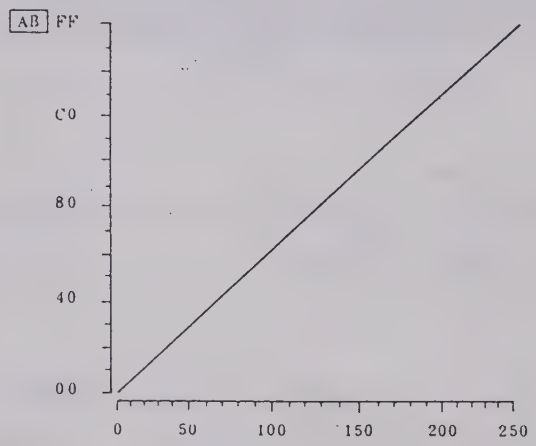


Fig. 7-30 Sample MAP 2 Display

(2) Shifting the vertical scale

As mentioned earlier, the screen can only hold one block of 256 at a time. Altogether, there are 256 such blocks so the user must specify what amounts to the upper half of the 16 bits address. (Note that this display is used with addresses far more than with data.) This is done through the input field located just to the left of the FF at the upper lefthand corner of the display. (Fig. 7-31) Start this input field blinking, type the new block number with the hexadecimal keys and register the change with the MAP key.

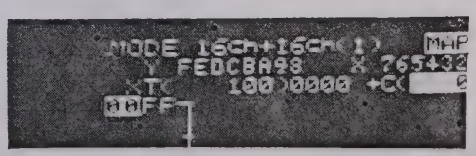


Fig. 7-31 Input Field for the Vertical Offset (Block No.)

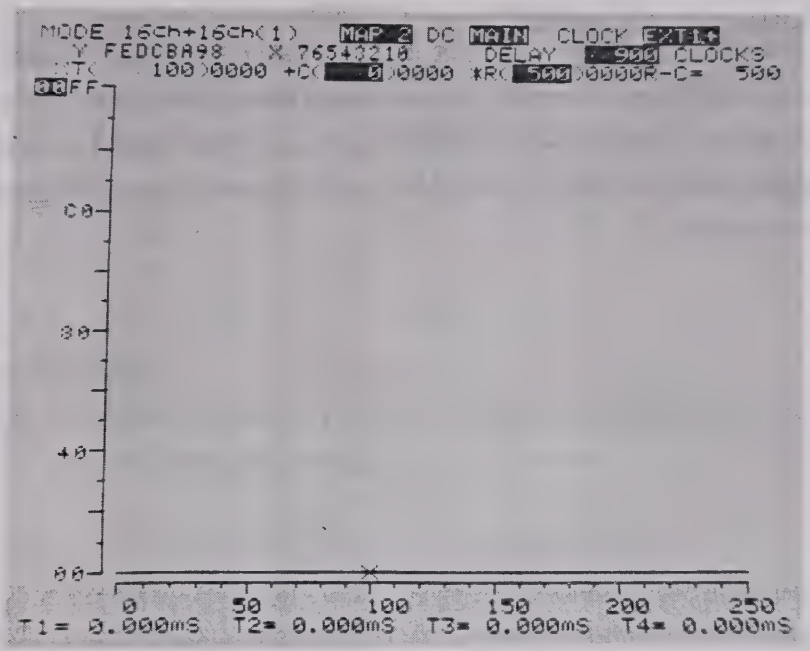


Fig. 7-32 Sample MAP 2 Display

(3) Shifting the C-CURSOR

The MAP 2 display always uses he C-CURSOR as the poionter to the left edge of the display. The cursor (and thus the display) can be shifted in much the same way as for MAP 1:

1) one memory location at a time with the CURSOR keys (15) and (16), or
2) one page (= 250 memory locations) at a time with the EDIT keys (17) and (19), or
3) by entering a new memory location in the C-CURSOR input field.

(4) Shifting the R-CURSOR

The R-CURSOR appears on the display as an asterisk. It can be moved one step at a time with the R-CURSOR keys (13), (14) or by specifying a new memory location in the input field.

When the R-CURSOR is on the screen, but the data is off, it appears as an arrow pointing towards the data.

The following topics covered under the same titles in Secitons 7-4 (4) through 7-4 (6) :

5) Changing the data acquisition conditions
6) Changing the channel sequence
7) Changing the polarity

(8) Another use for the MAP 2 display

The MAP 2 display can also act as a digital-analog converter to display data. For example, let us attach Probes D and C to and synchronize them with the output from an analog-digital converter. (For an 8-bit converter, ground Probe D and use only Probe C) If we set the vertical offset to "00" , the MAP 2 display will show the converter output reconverted back to analog.

SECTION VIII
OUTPUT

The VP-3662A has four output terminals TRIG OUT 1, 2, RESET OUT and VIDEO OUT.

8-1 TRIG OUT 1

(1) 32ch, 16ch(2) mode

The output is normally HI level (TTL). It goes LO when detecting all the trigger words specified for four levels of sequential trigger in MAIN mode.

(2) 16ch(1) mode

The output is normally HI level (TTL). It goes LO when detecting all the trigger words specified for four levels of sequential trigger of probes D and C in MAIN mode.

NOTE

A protective resistor is inserted in series to the output as shown in Fig. 8-1.

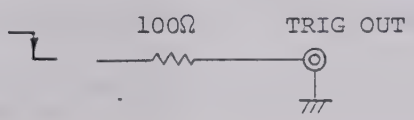


Fig. 8-1

The terminal recovers to HI level from LO when RUN/STOP key is pressed to start acquisition.

It does not change the state if the acquisition is forced to be interrupted by pressing RUN/STOP key.

8-2 TRIG OUT 2

In 16ch(1) mode, when detecting all the trigger words specified for four levels of sequential trigger of Probes B and A in MAIN mode, HI level (TTL) changes to LO.

NOTE

Same as NOTE in paragraph 8-1.
In glitch triggering the level does not change even if it detected a glitch.

8-3 RESET OUT

When pressing RUN/STOP key to start acquisition, negative pulse output (TTL, 150 ms duration) is provided.

This output can be used as a initialyzing signal for the system under test.

Data acquisition starts after this negative pulse is finished.

8-4 VIDEO OUT

The connector pin assignment is shown in Fig. 8-2 and Table 8-1.

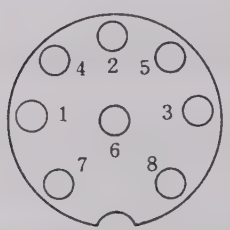


Fig. 8-2 VIDEO OUTPUT Connector
(Seen from outside of rear panel)

Pin No.	Signal
1	V sync
4	Video output
6	GND
7	H sync
3	Sync clock

Table 8-1 Pin Assignment

NOTE

VIDEO output signal of this instrument is exclusively used for video printers. It cannot be used for an ordinary picture monitor.

SECTION IX
OPTIONS AND ACCESSORIES

A full range of options and accessories is available to extend the power and versatility of the VP-3662A Logic Analyzer.

(1) Personality kits for 8-bit microprocessors

Model No.	Name	Applicable to (among others)
VQ-059U01	8080 Personality Kit	INTEL 8080A, 8080A-1, 8080A-2
VQ-059U02	8085 Personality Kit	INTEL 8085A, 8085A-1
VQ-059U03	Z-80 Personality Kit	Zilog Z-80, Z-80A
VQ-059U04	6802 Personality Kit	MOTOROLA MC6800, MC68A00 MC68B00, MC6802
VQ-059U05	6809 Personality Kit	MOTOROLA MC6809, MC6809E

(2) Personality kits for 16-bit microprocesors

Model No.	Name	Applicable to (among others)
VQ-059U11	8088 Personality Kit	INTEL 8088
VQ-059U12	8086 Personality Kit	INTEL 8086, 8086-1, 8086-2 8086-4
VQ-059U13	Z-8001 Personality Kit	Zilog Z-8001
VQ-059U14	Z-8002 Personality Kit	Zilog Z-8002
VQ-059U15	68000 Personality Kit	MOTOROLA MC68000

(3) Other Optional Accesories

Model No.	Name
VQ-036N21	GP-IB Analyzer
VQ-036N32	GP-IB Interface
VQ-036N24	RS-232-C Output
VQ-036N30	RS-232-C Adapter
VQ-036N41	RS-232-C Analyzer

Personality Kits

These kits adapt the VP-3662A Logic Analyzer to the specific characteristics of the microprocessor being used to further speed up the development, debugging, and testing process for new software and peripheral hardware.

The Personality Kit gives the VP-3662A the ability to disassemble the microprocessor's instructions as they are being executed on the bus and display them in the more readily understood assembly language mnemonics.

Fig. 9-1 is a photograph of one such display for a test of the operation of system built around an INTEL 8088 16-bit microprocessor.

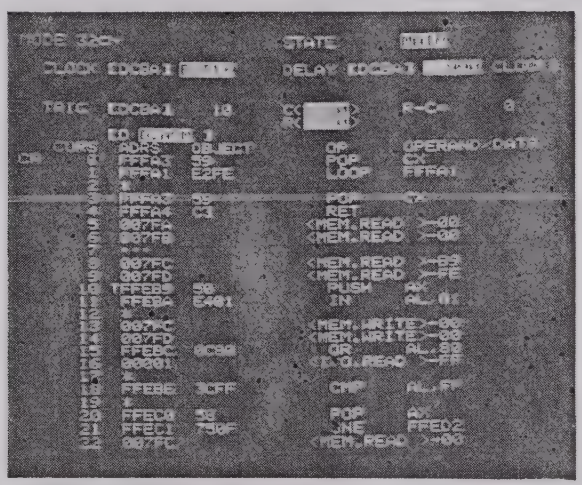


Fig. 9-1 Display of 8088 Mnemonics

GP-IB Analyzer

This option enables the VP-3662A to read in the signals from a General-Purpose Interface Bus and display them in the GP-IB mnemonics.

GP-IB Interface

This option, when added to the VP-3662A permits both remote-control operation and data output to the GP-IB controller.

RS-232-C Output

This option provides serial output of the screen display to drive a printer.

RS-232-C Adapter

This adapter converts serial data from the RS-232-C bus into the parallel form for display on the VP-3662A screen in any one of four notations : binary, octal, hexadecimal, or the ASCII codes.

RS-232-C Analyzer

With this option, the VP-3662A can monitor the serial data on an RS-232-C bus. It can handle both full- and half-duplex communications in start-stop synchronization, character synchronization, SDLC, and HDLC modes. (see Fig. 9-2 for a sample display)

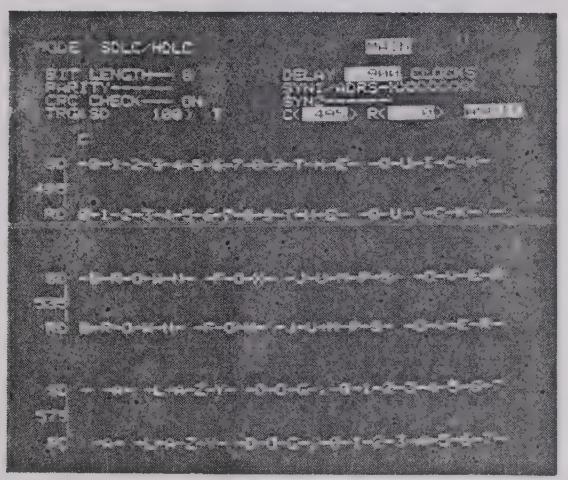


Fig. 9-2 RS-232-C Analyzer Display

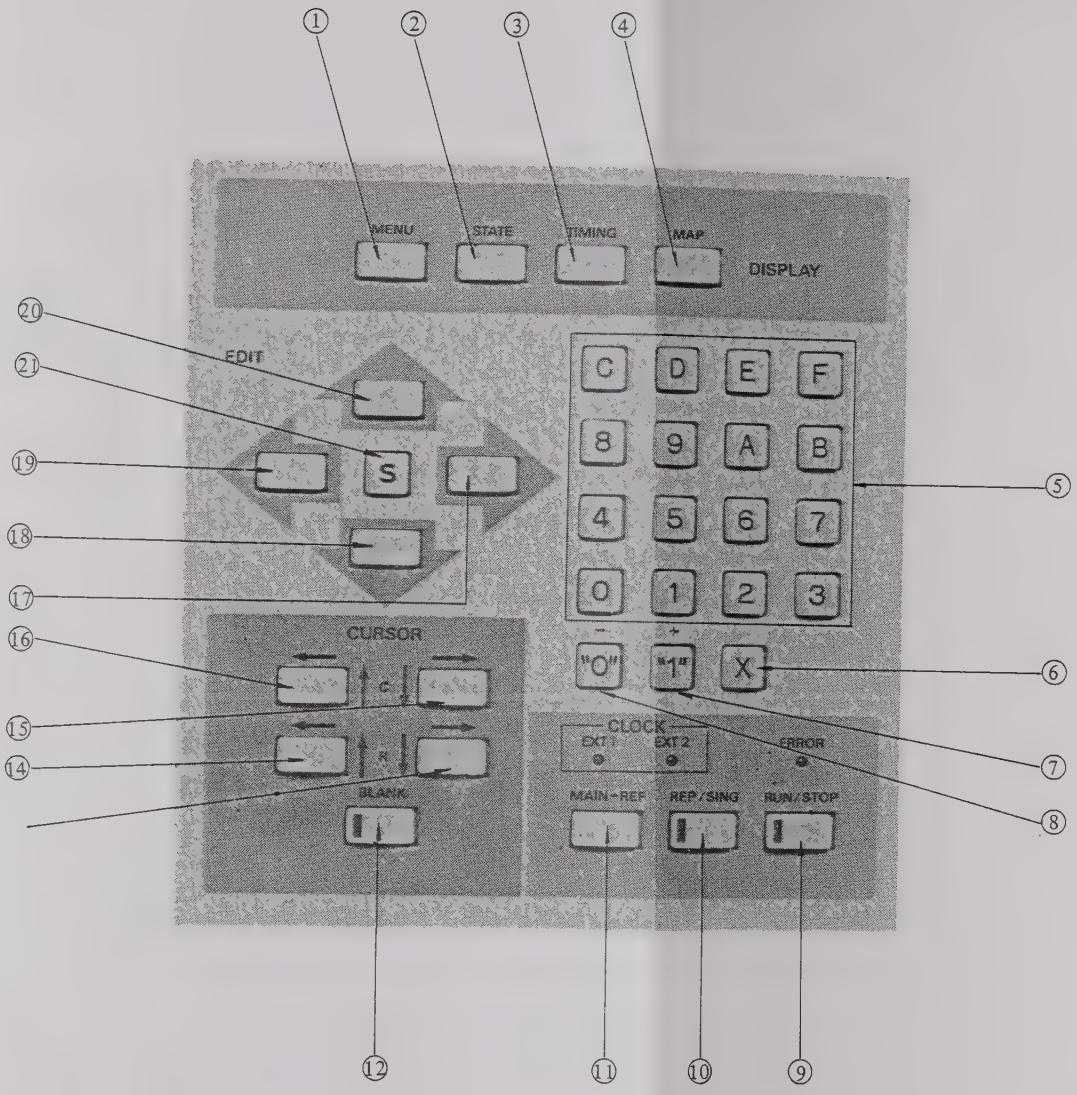


Fig. 10-1 Keyboard

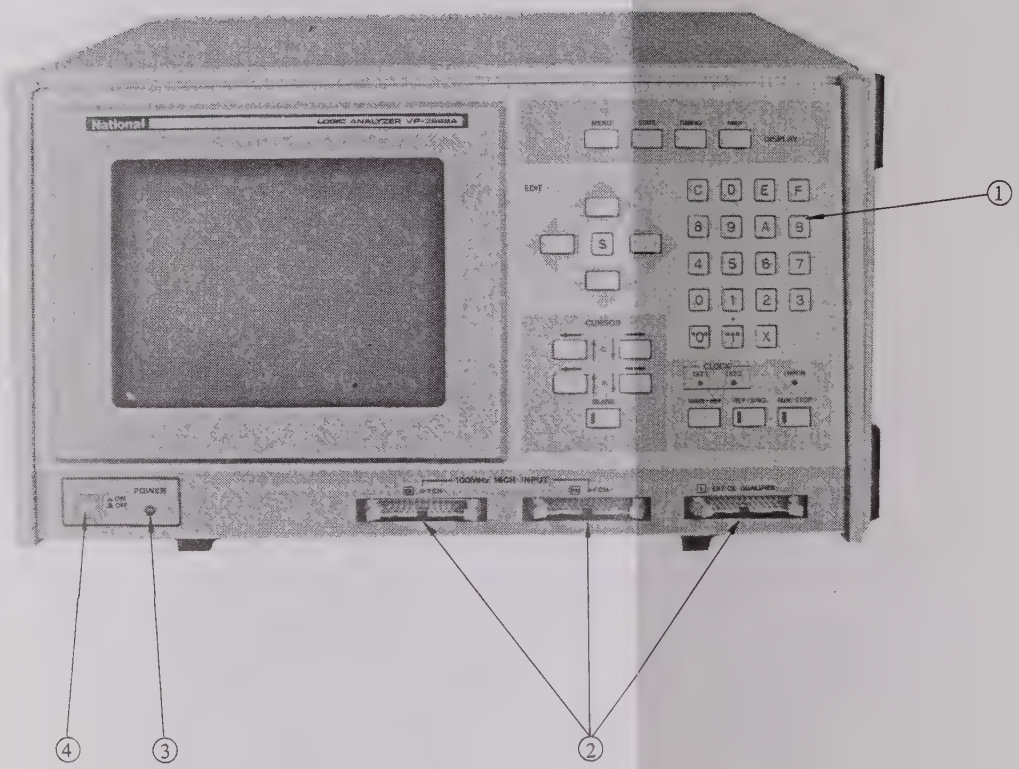


Fig. 10-2 Front Panel

1. Keyboard
2. Input connectors for HIGH mode probes
3. Power indicator light
4. Power switch

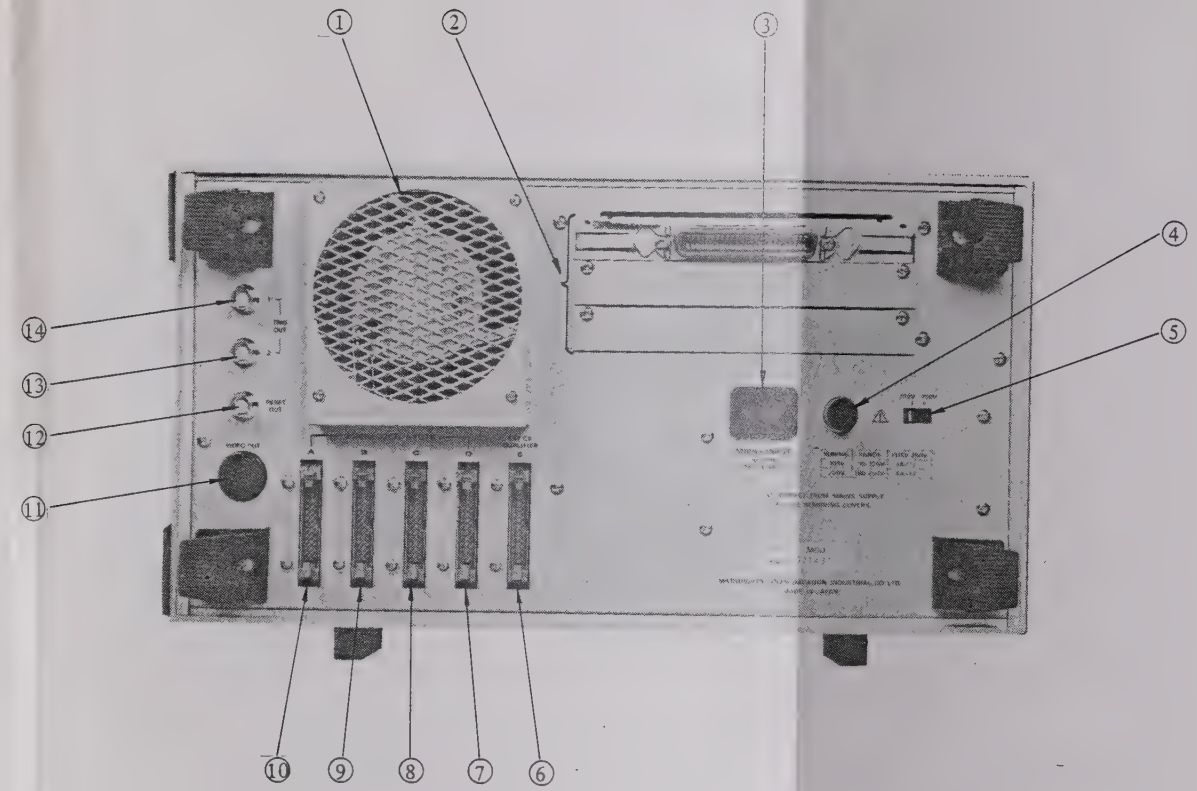


Fig. 10-3 Rear Panel

① Fan
② Reserved for options
③ Mains voltage selector
④ Fuse holder
⑤ Mains inlet socket
⑥ Probe E connector
⑦ Probe D connector
⑧ Probe C connector
⑨ Probe B connector
⑩ Probe A connector
⑪ Output connector for video printer
⑫ Reset signal output connector
⑬ TRIG OUT 2 connector
⑭ TRIG OUT 1 connector

Page

Q

Qualifier ..... 5 - 49

R

Reference memory ..... 5 - 67
REPEAT mode ..... 5 - 6, 6 - 18
RESET IF ..... 6 - 15

S

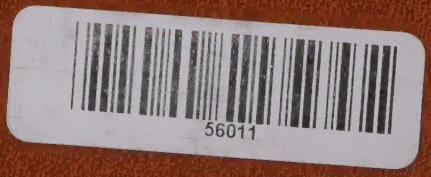
SAMPLE mode ..... 5 - 24
Scroll ..... 5 - 60
Search ..... 5 - 69
SEARCH menu ..... 5 - 14
Self-diagnosis ..... 4 - 1
Sequential trigger ..... 5 - 25, 5 - 42
Set-up time ..... 5 - 23, 6 - 3
SINGLE mode ..... 5 - 6, 6 - 18
Skew ..... 5 - 55
STATE key ..... 5 - 4
State table ..... 7 - 1
STOP key ..... 5 - 5
Synchronous sampling ..... 6 - 2

T

Threshold ..... 5 - 18, 6 - 1
Trace mode ..... 4 - 2
TIMING key ..... 5 - 4
Timing diagram ..... 7 - 1, 7 - 17
TRACE 1x2x3x4 ..... 5 - 32
TRACE 1·2·3·4 ..... 5 - 35
Triggering ..... 5 - 25
Trigger time measurement ..... 5 - 65

Z

Zooming ..... 5 - 70


56011